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The Implications of Globalization on the Sustainability of Society

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Abstract

This study examines the implications of globalization through the analysis of individual facets of society and their dependencies upon one another. Educational methods are adapting to the need for a greater amount of knowledge and competence among the populations in a global society. Due to the increased frequency of international dialogue, developments in communication, such as the establishment of a lingua franca, are becoming increasingly important in global relations. The emergence of a global society also calls for new and effective economic policies in order to create a global resource pool. As international ties strengthen, individual nations are presented with the increased responsibility of making advancements in clean energy technology to ensure the welfare of the planet and the sustainability of essential, limited resources, which are required by billions of people worldwide. Furthermore, as globalization progresses, agricultural sustainability must be taken into account to ascertain food security. Throughout this study, each aspect of society is isolated and its inner-workings are analyzed such that the intricacies of the interdependencies can be inferred. This analysis culminates in an assessment of the implications of globalization as a whole. Conclusively it was determined that globalization is inevitable, its factors are fragile and dynamic, and the extent to which it grows is finite.

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INTRODUCTION

"It has been said that arguing against globalization is like arguing against the laws of gravity" – Kofi Annan (Crossette, 2000). As evidenced by these powerful words, globalization is a trend that is sweeping across the world with unstoppable force. It is the process by which world cultures are growing closer together in all aspects of life, sharing knowledge, technology, and energy across borders, and creating economic and political unions. Due to the nature of globalization itself, everyone in the world is affected by it, even those who do not wish to be. As globalization changes the ways of life for people in every nation, care must be taken that the changes go in a sustainable direction.

Every feature of society is affected by globalization. Education is moving towards integrated curricula that emphasize the utilization of knowledge from multiple fields in order to solve real problems. The shift in communication is towards faster and better means of transmitting messages which provide more context essential to intercultural exchanges. A unifying lingua franca to facilitate communication between people of different cultures is also a necessity in a global society. Another effect of globalization is the increasing popularity of regional currency areas to both foster international trade and decrease the likelihood of further financial crises. Within the realm of energy, there is a growing importance for the utilization of sustainable resources as a replacement for depleting supplies of environmentally unfriendly fossil fuels, and for making sure that they are available worldwide. Sustainability, as it pertains to agriculture, puts emphasis on the implementation of practices that do not degrade the land or oceans used to provide crops, livestock, and fish. These problems affect the world as a whole because it has only finite resources, so global policies regulating these practices become paramount.

Due to the interconnections of the various facets of society, moving towards a globally sustainable civilization is imperative. Without global cooperation, such sustainability cannot be achieved, however not every aspect of globalization is feasible or desirable. It is important to thoroughly explore each part of human culture that will be affected by globalization in order to fully understand its consequences. Only after careful evaluation of the pieces that build the puzzle of society is it possible to draw conclusions about globalization as a whole.

THE RISE OF KNOWLEDGE DRIVEN ECONOMIES

In laymen's terms, globalization is the process in which the world is becoming increasingly connected. Through this process, regional economies, societies and cultures that were once disassociated from one another are becoming more integrated due to a network of communication and trade that is gradually encompassing the globe. Usually, globalization is discussed in the economic sense, in which it can be thought of as the movement toward a "single world market" via the transnational movement of goods, services and capital. Regardless of the manner in which globalization is defined, it is recognized that this progression toward a global society, which is becoming more and more evident in everyday life, is the result of a combination of economic, technological, socio-cultural, political, and even biological factors.

Information and innovation form the foundation of globalization; and these two bases of globalization are knowledge-intensive. According to the *Oxford English Dictionary*, knowledge is defined as the "information and skills acquired through experience or education" (Soanes, & Hawker, 2008). However, in a world that is becoming economically intertwined, knowledge is also coming to be considered a sort of good, which, along with communication and information, influences the enormous movements of capital in today's global markets. This knowledge is not a private good, such as the type of knowledge that underlies new products and services and is protected by patents. Instead, it is public and fundamental: "how to organize firms, how to organize societies, [and] how to live healthier lives in ways that support the environment" (Stiglitz, 1999). It is the kind of knowledge "that affects fertility and … the design of

economic policies that promote economic growth" (Stiglitz, 1999); it is in the public domain and can be possessed by multiple persons simultaneously.

Since knowledge is fundamental to globalization, it is only logical that the transfer of knowledge through education plays a rather important role as well. Educational institutions are becoming more and more like factories, producing intellectual capital that can be cultivated and implemented along with monetary capital by major economies in order to better operate in the global marketplace. The dependence of globalization on knowledge has certain implications for educational systems worldwide, and such implications concern the public perception of education and educational reforms.

Changing Views on Education

The common outlook on education is changing as globalization yields global, science-based, knowledge-driven economies. The main reason behind this is simple: value is being placed on education, and higher salaries are going to those who obtain the education needed to fulfill the economical, technological, and social demands of the global society. Therefore, many see it as necessary to learn at the university level in order to get a reputable, well-paying job. This mentality can be seen in the academic enrollment trends of various countries around the world. The following table displays the total number of tertiary-level graduates for the world's top five economies (as chosen by the International Monetary Fund according to GDP values of the year 2009).

DATA	Total graduates in all programmes. Tertiary. Total										
YEAR	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
COUNTRY											
China	...	1,775,999	1,804,660	1,948,080	...	3,977,882	5,004,102	5,622,795	5,872,815	7,071,047	...
Japan	1,113,328	1,081,435	1,067,878	1,047,890	1,040,354	1,051,262	1,059,386	1,067,939	1,062,444	1,033,774	...
France	497,188	500,079	...	532,083	584,849	664,711	643,604	622,937	...	621,444	...
Germany	315,257	302,095	296,640	293,920	304,773	319,791	343,874	359,365	377,851	467,335	...
United States	2,069,033	2,150,954	2,174,142	2,238,327	2,355,724	2,473,299	2,557,595	2,639,006	2,704,070	2,782,270	...

Figure 1: Total number of tertiary-level graduates for the world's top five economies from 1999 to 2008 (UNESCO Institute for Statistics)

In Figure 1, empty cells indicate the absence data. With the exception of Japan, these major economies have all experienced a net increase in the number of tertiary-level graduates who are ready for university training, showing that the necessity of education in today's society is becoming increasingly recognized. This trend is also due partially to technological advances. New technologies have reduced the demand for unskilled and semi-skilled labor. An example would be the gradual (but evident) replacement of human workers with automated machines on product assembly lines. Eventually, the job market will only benefit those with a higher education.

The New Face of Education

As globalization shapes the economic relations between nations, it is also shaping what and how students learn. It is the objective of educational systems around the world to produce versatile and able workers whose skills are relevant to the happenings of the global society. Thus, in order to mold such competent individuals, educators are reshaping curricula, changing the way they transfer knowledge, and promoting teamwork.

The Benefits of Holistic Curricula

Most current education systems take a discrete, compartmentalized approach to teaching. Academics are divided into rigid disciplines, with each discipline focusing on its respective unit of research. However, a holistic approach to teaching, one that is integrated, would be much more beneficial in preparing students for work in both today's society, and that of the future. In order for one to be productive in an economically, politically, and technologically interwoven world, one must have a thorough understanding of relationships and systems such as world systems (e.g. the United Nations and the World Trade Organization) and business eco-systems (networks in which several organizations, involved in the distribution of a particular good or service, thrive through cooperation and competition).

The prime goal of education is to provide students with knowledge so that they can implement this knowledge as they enter the working world. However, knowledge that is fragmented into specific disciplines is hardly applicable to problems presented by real-life situations; solving such problems often requires a fusion of concepts that stem from separate disciplines. For example, a hemodynamicist would find it difficult to study blood circulation without a combined knowledge of anatomy, biological processes (such as the transport of oxygen throughout the body), chemical phenomena (such as the bonding of oxygen with the iron ion of a hemoglobin protein, without which oxygen transfer would cease to occur) and mathematical concepts (such as integration and differential equations, which are needed to study fluid flow in the discipline of fluid dynamics). A great deal of research has gone into the development and implementation of integrated curricula. Through the use of advance imaging technology, cognitive

scientists have been able to study the effects of interdisciplinary instruction on the brain, and they have observed that these effects are favorable. Challenging problem-solving facilitates the creation of new dendrite-connections in the brain, which in turn allows for making more connections between different concepts and ideas (Jenson, 1998). One of the best ways to promote such problem-solving is by way of enriched, integrated learning environments that allow one to make connections among various disciplines.

In his article titled "Models of Curriculum Integration," Dr. Franzie L. Loepp of Illinois State University describes three models that can be used to achieve an integrated curriculum. The first model is referred to as the "Interdisciplinary Model" and is shown below.

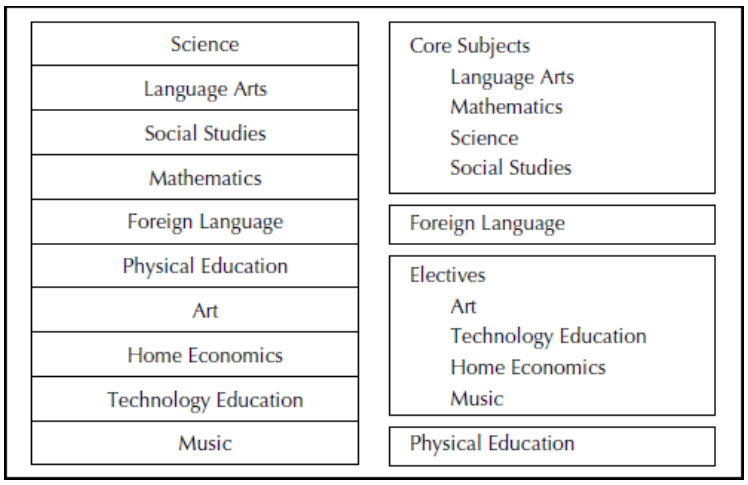


Figure 2: The Interdisciplinary Model (Loepp, 1999)

According to this model, the traditional subjects (shown on the left) are divided into four blocks (shown on the right). Each block is instructed by a team of instructors (or only one instructor in the case of foreign language and physical education), and each team of instructors is given a certain number of students and expected to provide an interdisciplinary curriculum. This method of instruction is advantageous in several ways. Due to the grouping of different disciplines, instructors are given time to work together

and collaborate, allowing them more of a chance to create lesson plans that draw multiple disciplines together. Also, the instructors are primarily responsible for a small number of students, providing the opportunity to forge closer instructor-student relationships and to better interact with the students during lessons. Furthermore, by grouping different disciplines into clusters, the instructors are granted greater scheduling flexibility; for example, the mathematics instructor would not have to worry about infringing on the class time of the other three instructors who teach core subjects, since all four instructors are allotted a block of time which they can divide as they please. Nevertheless, there are some disadvantages to this model. First of all, the Interdisciplinary Model does not force instructors to take on an integrated curriculum; this model could easily be used to support a traditional, discipline-segregated teaching style. Secondly, standardized integrated curricula are scarce, and it would take a significant amount of time and effort for administrators to produce a curriculum of their own.

The second model described by Dr. Loepp is the "Problem-based Model." This model takes into consideration the fact that today's society is becoming increasingly grounded in technology by placing technology education at the core of the curriculum. The modus operandi of this curriculum integration model is simple: present the students with a technological problem, and then use the various disciplines to work toward a solution. This curriculum model is depicted in the following diagram.

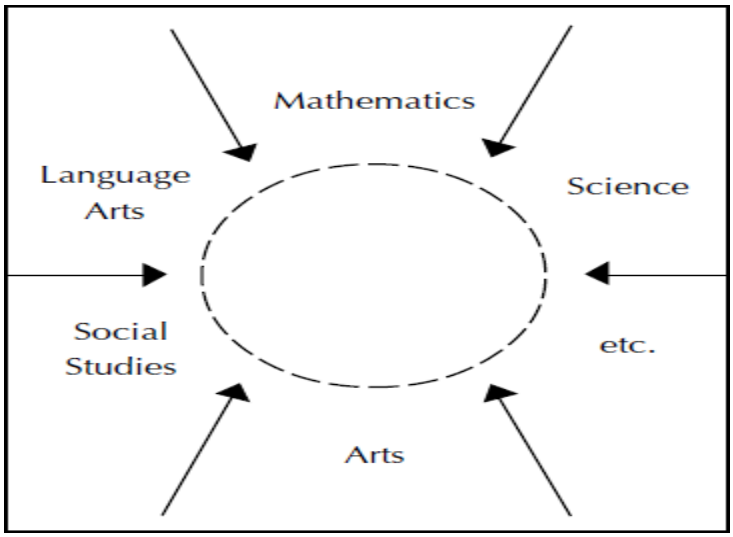


Figure 3: The Problem-based Model (Loepp, 1999)

In order to demonstrate how this form of curriculum integration works, Dr. Loepp provides an example problem which requires students "to determine how the waste produced in a community could be turned into an asset" (Loepp, 1999). As to the solution of this problem, Loepp states:

> In this instance, the social studies class can address the role of local government in collecting and disposing of waste; in science the emphasis could be on reducing materials to their basic elements and recombine them; and in mathematics one could study measurement, area, volume, and so forth. In technology education, the focus might be on the various technologies used to separate waste into categories as well as the transformation of waste into usable materials (Loepp, 1999).

A key benefit of this curriculum integration model is that it can be used to provide students with insights into technological problems that are relevant today and will be relevant in the near future. However, utilizing this model makes it difficult to assure that national educational standards are met, since learned material is limited by the problems.

The third and final curriculum model is referred to as "Theme-based Education." As seen in the diagram below, this model is similar to that of the traditional teaching model.

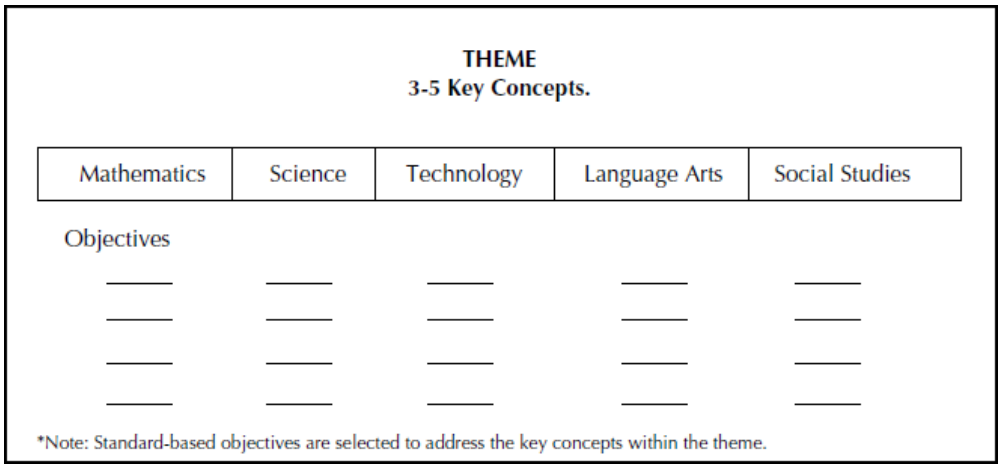


Figure 4: Theme-based Education (Loepp, 1999)

Instructors are allowed to identify with a given, rigid discipline; however, all instructors are connected by a single theme, allowing students to independently make comparisons among their various classes. This model also makes it easier for schools to adhere to national standards and state educational frameworks due to the standard-based objectives that drive the exploration of a certain theme. Yet this curriculum model is also disadvantageous, in that a theme may not always relate to each and every specific discipline, leading instructors to engage students in irrelevant and superficial learning.

With each presented integrated curriculum model comes advantages as well as disadvantages. However, it appears as though the pros far outweigh the cons. The few schools that have made the transition to an integrated curriculum have found that an interdisciplinary teaching method not only increases academic curiosity and attendance among students, but it is also effective in decreasing dropout rates. Every day, 7,000

American students, many of whom feel that the segregated academic disciplines put forth by conventional curricula are irrelevant to everyday life, drop out of school, causing only about 70% of students to graduate from high school with a regular high school diploma (United States Committee on Education and Labor, 2009). These statistics are alarming, and if the United States intends to maintain its status as a major competitor in the global economy, it should seriously consider reviewing its educational system. A nationwide shift to integrated curricula, which help students relate academics to life, would be a wise choice.

Abstract Teaching for the Transfer of Abstract Knowledge

In classrooms and lecture halls worldwide, students have the privilege of being presented with ready-made problems that provide a wealth of information. However, solving such problems will not effectively prepare students for the chaotic global economy. First of all, economic problems are seldom clearly defined; they must be sought out and identified. Secondly, the information required to solve these problems must be gathered; it is not simply provided by a professor. Most importantly, one must make decisions and assumptions in order to propose a solution. Therefore, in order to contribute to the complex global economy, students must be accustomed to abstract concepts and realistically uncertain situations. Furthermore, students must be able to effectively acquire and apply knowledge retrieved from various technologies such as the Internet and CD-ROM, as well as print, audio, video and additional forms of electronic media.

For instructors, transferring abstract knowledge, such as mathematical concepts, proves difficult. For students, applying abstract knowledge to real-world situations is

equally challenging. Therefore, an essential question that rising knowledge-driven economies must answer is: how can instructors convey abstract ideas to students, such that students can effectively apply such ideas to new situations? A study at Ohio State University helped to answer this pressing question.

In 2008, researchers at Ohio State University's Center for Cognitive Science conducted a study with undergraduate students in order to determine whether students benefit more from learning mathematics using a single abstract, symbolic representation than from using a series of concrete examples. This study consisted of four experimental trials. In the first experiment, eighty study participants were each assigned to one of four instantiations in order to learn a simple mathematical concept. Then, the participants were asked to apply this concept to a novel instantiation. The mathematical concept used during this study "was that of a commutative mathematical group of order three. This concept is a set of three elements, or equivalence classes, and an operation with the associative and commutative properties, an identity element, and inverses for each element" (Kaminski, Sloutsky, & Heckler, 2008). One of the four instantiations was generic, "a written language involving three symbols in which combinations of two or more symbols yield a predictable resulting symbol" (Kaminski, Sloutsky, & Heckler, 2008). The remaining three instantiations were concrete and contextualized, using images of measuring cups containing varying levels of liquid, images of slices of pizza, and images of tennis balls in a container (designated as Concrete 1, Concrete 2, and Concrete 3 respectively) in order to portray the mathematical concept. The table below explains the mathematical concept in terms of the generic instantiation and the concrete instantiation known as Concrete 1 (which is identical to Concrete 2 and 3).

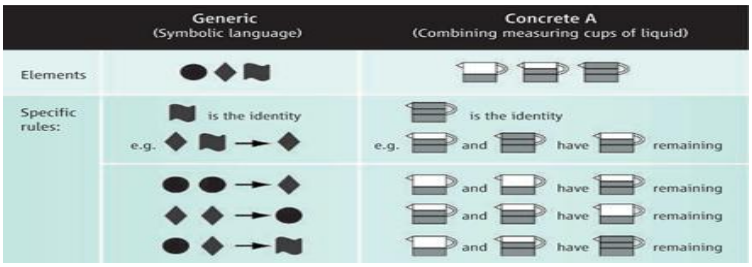


Figure 5: Generic instantiation and Concrete 1 (Concrete A) (Kaminski, Sloutsky, & Heckler, 2008)

All participants, regardless of their assigned instantiation, received equal training; each individual was presented with the same number of examples, questions with feedback and test questions. After training, the participants were presented with the same task, which was used to determine how well each participant could apply the newly learned mathematical concept to a novel concrete instantiation. This concrete instantiation was identical in structure to instantiations Concrete 1, Concrete 2, and Concrete 3 used in the learning process.

> [The novel instantiation] was described as a children's game involving three objects. In the game, children sequentially pointed to objects; and a child who was 'it' pointed to a final object. If the child pointed to the correct final object, then he or she was the winner. The correct final object was specified by the rules of the game (rules of the mathematical group) (Kaminski, Sloutsky, & Heckler, 2008).

Though the participants received no training for this novel instantiation, they were informed that the rules of the game were similar to those of the mathematical systems employed by the instantiations used in training. The participants were allowed to analyze a series of examples in order to deduce the game's rules, and then they were given a 24-question multiple choice test that was isomorphic to the tests that they received during

training. The test scores for the first experiment are represented in the following bar graph.

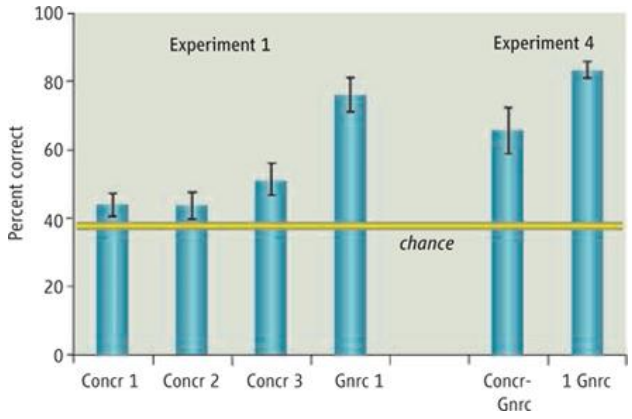


Figure 6: Test Scores for Experiment 1 and Experiment 4 (Kaminski, Sloutsky, & Heckler, 2008)

During training, all participants, regardless of learning conditions, learned the mathematical concept with equal success and speed. However, in the case of applying the mathematical concept to a novel instantiation, the participants that trained using generic instantiations clearly outperformed those who used concrete instantiations. In Figure 5, the yellow line labeled as "chance" represents the maximum test score with which a particular treatment or condition, such as Concrete 1 or Generic 1, can be considered to have no effect on results. One can see that the test scores obtained by those who learned through concrete instantiations fall rather close to this boundary (which is defined by a test score slightly below 40% correct), while the average test score achieved by participants who learned with the aid of generic examples far exceeded it, approaching 80% correct. The test scores were also analyzed in terms of p-values. The p-value is the probability of obtaining a test statistic, assuming that the null hypothesis (which proposes that a treatment, such as one of the four instantiations used in training, has no effect on results) is true. In other words, the lower the p-value, the less likely it is that the null

hypothesis holds; p-values less than 0.05 or 0.01, which correspond to a 5% chance and a 1% chance (respectively) of obtaining a result in the case of a valid null hypothesis, are often enough to reject the null hypothesis. In experiment 1, a p-value of less than 0.005 was associated with the test results of the participants who trained with generic knowledge transfer. Therefore, it can be concluded that training with generic instantiations was effective. A p-value greater than 0.35 was associated with the test results of the participants who trained in conditions Concrete 1 and Concrete 2, and a p-value of 0.06 was associated with the test results of those who trained in condition Concrete 3, leading to the conclusion that concrete instantiations are not as effective as generic instantiations in knowledge transfer.

After experiment 1, researchers in the Center for Cognitive Science performed three more experiments. In the second experiment, 20 participants were asked to learn Concrete 1 and Concrete 2 instantiations and were provided with the alignment of analogous elements across the two learning instantiations for assistance. Even with the added help, there appeared to be no improvement in knowledge transfer (p-value > 0.35, test scores not above chance). In experiment 3, 20 participants were asked to first learn instantiations of types Concrete 1 and Concrete 2 and to then compare these two instantiations by matching analogous elements and observing any similarities. Despite the fact that, in past experiments, explicit comparisons have been shown to facilitate knowledge transfer, the resulting knowledge transfer was not convincing. The test results were bimodal: 44% of participants scored highly (95% correct +/- 4.7%) and the remaining participants performed poorly (51% correct +/- 11.6%). This led the researchers to believe that comparisons may help high-performing learners apply

knowledge, but that they are not all-around effective. In the fourth and final experiment, 40 participants were assigned to one of two learning conditions: 1) a generic condition in which participants learned the generic instantiation, or 2) a concrete-then-generic condition in which participants learned the Concrete 1 instantiation followed by the generic instantiation. The results to this experiment are displayed above in the bar graph of Figure 5, which shows that, although learning in a concrete-then-generic condition was more successful than learning in a condition based solely on concrete instantiations, generic learning still prevailed.

The results of this experiment show why major economies hoping to produce a knowledge-driven economy are turning to abstract knowledge transfer: when learning, generic instantiations help while concrete instantiations hinder. Instantiating abstract concepts, such as mathematical concepts, in a concrete and contextualized fashion constrains learners' knowledge, limiting learners to applying knowledge to instantiations similar to those that they have become accustomed to in training. Only through generic, symbolized knowledge transfer can today's students learn abstract concepts in a way that will allow them to tackle the real world issues posed by the growing global society.

The Importance of Teamwork

Around the world, businesses are promoting teamwork among employees as a means of boosting efficiency in the workplace, and such teamwork has been shown to produce desirable results. Normally, workers are separated by the various sections of a company, as well as its administrative hierarchy. However, teamwork counteracts such segregation and allows employees from different departments and organizational levels to interact, improving working relations and ultimately leading to smoother operation within

the company. Furthermore, teams bring various ideas, feelings and insights together, harnessing the creative power of a company and allowing the company's goals and visions to be better carried out. However, in order for teams to function well, team members must possess certain skills which include, but are not limited to, interpersonal skills, intercultural skills, and foreign language skills. Such skills are being acquired more and more by students prior to entrance into the world of global business.

According to an article in the *Harvard Business Review* titled "The Discipline of Teams," a team is defined as "a small number of people with complementary skills who are committed to a common purpose, set of performance goals, and approach for which they hold themselves mutually accountable" (Katzenbach & Smith, 1993). Such unity within a group of people cannot arise without the members possessing interpersonal skills. Such skills include the ability to provide constructive criticism, the ability to accept helpful criticism, objectivity (the ability to set personal feelings and opinions aside in order to reflect on matters from an unbiased standpoint), active listening (the ability to understand, interpret and evaluate what one hears) and the ability to recognize the interests and the achievements of others. In order for one to attain such skills, one must become accustomed to working with others. Therefore, schools are striving to promote student collaboration, and thanks to technological advances, student collaboration is no longer bound by the walls of the classroom. New technologies have made it possible for students around the globe to connect with one another, and such technologies are becoming more and more mainstream in educational systems. An example of such technology is the use of "virtual teams," which are "groups of geographically, organizationally and/or time dispersed workers brought together by information and

telecommunication technologies to accomplish one or more organizational tasks" (Katzenbach, Smith, & Ives, 2004). According to a case study conducted by Kathy Egea of Central Queensland University in Rockhampton, Australia, virtual teams can be very conducive to the development of interpersonal skills. Electronic media of communication, such as email, can actually make interpersonal relations challenging when they don't allow for verbal interaction. For example, one student in the study, designated as student g3t2p2, noted in their log that as "members were aware of the limitations of email as a conversation media, the 'tone' of the messages were kept light and encouraging so there was no misunderstanding regarding the intention of the members' conversation" (log 2, g3t2p2). This shows that virtual communication not only requires the clear and concise conveyance of ideas, but also the appropriate diction, which can make or break relationships between group members. This concept can be carried over to and implemented in groups that are physically connected in the classroom or workplace. Student g3t4p1 observed that "[she] typed a lot faster than [g3t4p2] and … found that [she] needed to slow down and let her respond before typing a new question or statement" (log 1, g3t4p1). This observation shows that virtual communication raises awareness of the importance of a harmonious conversation in which there is equal input from participating parties. Therefore, it is clear that virtual communication is a useful tool for helping students to develop interpersonal skills. By taking away the verbal aspect of communication, it pushes students to consider which underlying communicative elements are essential in developing and maintaining a productive and healthy group relationship.

With the rise of more and more global businesses, it is becoming increasingly common to have culturally diverse teams in the workplace, and in regards to such groups, interpersonal skills are sometimes just not enough. Usually when one develops interpersonal skills, one develops such skills based on the social and cultural norms of a society, which is only natural. However, these skills may not come in handy when dealing with a team in which the social and cultural norms of individual members differ. Such a case requires some degree of intercultural awareness, which is being acquired more and more through exchange programs. Students everywhere are learning of the importance of international competence and are being encouraged to study abroad, with promising results. For example, the United States has experienced a surge in the number of students taking the opportunity to study in a foreign land. According to the United States' National Center for Education Statistics, from "1987-88 to 2007-08, the number of U.S. students studying abroad [more than] quadrupled, rising from 62,300 to 262,400 students" (National Center for Education Statistics, 2010). Furthermore, over the past two decades, the geographic distribution of these exchange students has shifted. In 1997-98, 64 percent of U.S. exchange students studied in Europe. By 2007-08, this figure decreased to 56 percent, with many students venturing to less-visited territories such as Latin America, Asia, Africa and Oceania. This shift in travel destination shows how once-obscure countries are coming onto and connecting to the global scene through globalization. The said figures are displayed in the table below:

Host region	1987–88	1993–94	1997–98	2002–03	2003–04	2004–05	2005–06	2006–07	2007–08
					Number of students				
Total	**62,341**	**76,302**	**113,959**	**174,629**	**191,321**	**205,983**	**223,534**	**241,791**	**262,416**
Africa	748	1,477	3,071	4,827	5,699	7,100	8,459	10,066	11,844
Asia	3,803	4,986	6,836	9,751	13,213	16,571	20,811	24,969	29,125
Europe[1]	47,005	51,395	72,592	109,907	116,446	124,292	130,274	138,871	147,676
Latin America	5,735	10,207	17,810	26,643	29,053	29,655	33,902	36,339	40,181
Middle East[1]	2,930	2,174	2,245	648	1,050	1,977	2,585	2,759	3,362
North America	873	509	983	1,269	1,136	1,121	1,151	1,389	1,237
Oceania	748	2,618	4,961	12,749	14,113	13,787	14,033	13,820	14,028
Multiple destinations	499	2,931	5,458	8,835	10,611	11,480	12,319	13,573	14,963
					Percentage distribution				
Total	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**
Africa	1.2	1.9	2.7	2.8	3.0	3.5	3.8	4.2	4.5
Asia	6.1	6.5	6.0	5.6	6.9	8.0	9.3	10.3	11.1
Europe[1]	75.4	67.4	63.7	62.9	60.9	60.3	58.3	57.4	56.3
Latin America	9.2	13.4	15.6	15.3	15.2	14.4	15.2	15.0	15.3
Middle East[1]	4.7	2.8	2.0	0.4	0.5	1.0	1.2	1.1	1.3
North America	1.4	0.7	0.9	0.7	0.6	0.5	0.5	0.6	0.5
Oceania	1.2	3.4	4.4	7.3	7.4	6.7	6.3	5.7	5.3
Multiple destinations	0.8	3.8	4.8	5.1	5.5	5.6	5.5	5.6	5.7

Figure 7: Distribution of U.S. students studying abroad from 1987-88 to 2007-08 (National Center for Education Statistics, 2010)

With the rise of culturally diverse teams in the workplace also comes the increasing demand for foreign language training. Multilingualism is becoming of great importance in a world in which individual cultures are more commonly interacting with one another. A great and relatively current example of the growing emphasis placed on foreign language skills is the formation of new foreign language policies within the European Union (EU). At a conference held on November 21, 2008, EU council members made long term goals in regards to the promotion of foreign language learning, including the promotion of multilingualism as a means of strengthening social cohesion, intercultural dialogue and European construction, the promotion of lifelong language learning that persists beyond the end of general education and the promotion of multilingualism as a factor in Europe's economic competitiveness and in the mobility and employability of the European people. Judging by statistics, it appears as though the EU has been successful in conveying the importance of foreign language training to the

European society, especially in terms of English. In the EU, non-native speakers of the English language are realizing the global importance of this lingua franca. Within EU education systems, it is typical for students to begin foreign language training at the beginning of secondary school, and it has been found that about 93 percent of students select English as their language of choice (Frias, 2000). The percentage of students learning English is even greater in the higher educational levels.

The world is coming together, and it is becoming increasingly important for individuals to be able to work harmoniously and productively with one another. While this requires basic interpersonal skills, intercultural training and foreign language training are more of a necessity, since professional teams are becoming more culturally heterogeneous. In some major countries, there has been a decrease in intercultural activity among students, which may have a detrimental effect in the future. For example, in Japan, the number of students seizing the opportunity to study abroad has decreased dramatically. In 2004, a record 82,945 Japanese students were studying at foreign institutions; as of 2008, this number had decreased substantially to 34,000 (Sugimori, & Shimbun, 2009). This trend is damaging to Japan's economical outreach, because a decreasing amount of students are orienting themselves toward the outside world.

Conclusion

Learning institutions are becoming more like factories that produce the knowledge needed to create new economic, as well as political, policies in this increasingly connected world. Transitioning to interdisciplinary curricula, teaching via abstract knowledge transfer, and preparing students for the team-based workplace are only three examples of the reforms taking place within educational systems. Many other

reforms are being made to produce versatile, globally aware workers who can cater to economic success. However, economic success requires that educational systems be just as versatile as their students. Times are economically and politically turbulent, and educational infrastructures must be flexible enough to adapt to the changing state of global affairs in order to keep students, and ultimately, knowledge, relevant and applicable to society.

The Pros and Cons of Globalization's Influence on Education

Thus far, it has been made clear that globalization is inducing educational changes everywhere. Now one must ask whether these changes are for the better or for the worse. The answer is the subject of great debate.

The advantages of globalization-induced educational reforms are quite obvious. The goal of education is shifting farther away from the social, cultural, and intellectual fulfillment of students, and closer toward the economic fulfillment of nations. Schools and universities are providing students with knowledge that is appropriate for current economic trends, in the same way that clothing stores provide consumers with clothing articles that are appropriate for the latest fashion fads. This relevance of knowledge is of course beneficial for knowledge-driven economies, for a knowledge-driven economy fueled by irrelevant knowledge would be incapable of forming applicable economic policies needed to stimulate economic growth. In turn, the public also benefits because a strong, healthy economy means a more comfortable standard of living as well as the availability of essential resources.

However, the problem with globalization-induced educational reforms is that they don't aim to satisfy the minds of the people. Of course, educational reforms such as integrated curricula, abstract teaching, and increased student collaboration are conducive to improved intellectual, cultural, and social development. Yet, the fact that education and knowledge are being treated more as something for the economy rather than something for the individual is quite bothersome. One could say that the individual benefits from learning to "be relevant" to the current society, but that is nonsensical. That which is relevant is always changing, meaning that knowledge and skills deemed as relevant now may be inapplicable in the future. This is not to say that inapplicable knowledge holds no value, but it seems somewhat unjust to feed people knowledge that suits the moment. Shaping education for economical progress is fine; it is in the mentality created by globalization where the problem lies. Governments see knowledge as a form of capital needed for economic gain. It may not be long until students see knowledge in this light as well. This way of thinking is already forming among many students today: one must learn in order to receive good grades, which are needed to qualify for a good job. Soon, this mentality might extend toward the economy: one must learn in order to receive good grades, which are needed to qualify for a good job that supports the economy. It is rather unsettling to think that learning, once such an intimate and self-fulfilling process, might come to this. Furthermore, if knowledge is seen as a form of capital or a commodity, what does that make those who possess knowledge? Are human beings becoming a commodity as well?

THE EVOLUTION OF COMMUNICATION IN A GLOBAL SOCIETY

"Everything speaks; everything is language" (Author unknown). This ancient African saying describes how large a role communication plays in everyday life. Every action that every person takes communicates a message to others. As globalization occurs rapidly throughout the world, it is imperative to note the relationship that this process has with communication. Globalization was largely brought about by the information age and the increase in communication technology. At the same time, Globalization itself is dictating how communication will change for the future.

Globalization is one of the most important issues at this time. Nations, multinational corporations and international organizations have been expanding their operations worldwide and forging global partnerships. Over the past few decades, doing business globally has been extremely important for companies whose growth is no longer domestically sustainable. Global expansion is a creature of both desire and necessity. This process is affecting and will continue to affect the way that humans live on a day-to-day basis. It affects economies, political structures, business organization, educational systems, and everything else under the sun. One of its most important relationships, however, is that with communication. How does globalization change the way that human beings transmit messages to one another? How will people need to modify their conventions to adapt to a new global society? How will globalization affect the different communication cultures in the world? These questions are all vitally important to the further development of society and even to the process of globalization itself. As the effects of globalization and the proliferation of the information age become more widespread and dramatic, society will need to answer them.

How Communication Technology has Influenced Globalization

The process of globalization did not start overnight. It has been brought about by the development of new technologies, a great number of which are directly related to communication. Inventions such as the telephone have made it increasingly easier to communicate over long distances. The transatlantic telegraph cable, first laid in 1856 transformed the amount of time to communicate a message overseas from about 10 days to a matter of minutes (Isaac, 1999). Of course, globalization had already begun at this point, but this was a landmark event. It meant that business could more easily be conducted on an international level without such hindrances and delays as had previously existed. It also encouraged collaboration and cooperation between people and companies thousands of miles apart. In fact, communication has been playing an integral part in bringing people together for thousands of years.

Over the course of history, there have thus far been three major information communication revolutions. The first occurred when man first drew on the walls of his cave. In doing so, he conveyed his thoughts to others in a pictoral form. The second occurred when writing appeared on mobile media, such as papyrus, wax tablets, or clay, and common alphabets were introduced, allowing messages to be more uniformly understood. Eventually mass production techniques were established to facilitate the circulation of ideas. The third revolution took place when people gained the ability to transmit information through the use of electronic signals and waves. Each of these revolutions had a drastic impact on the world at the time. Right now, the world is in the

midst of globalization that was largely encouraged by the third revolution mentioned above.

The electronic transmission of messages has revolutionized the way that most people live their lives. It is now feasible to do business on the other side of the globe with only minimal differences from how one would conduct business with someone in the same room. The Internet has made it possible to share ideas and information at a speed that was once unimaginable. The sharing of ideas in such a way has allowed concepts to spread across the globe like never before and unite people of a multitude of backgrounds. The spread of technology has brought about a "democracy of information" (Friedman, 2000). People from places that have historically been oppressed can now share ideas much more easily with people outside the reach of their oppressors. People in less developed countries now have access to information that was previously reserved for the elite of the developed world. This sharing of information has allowed people to grow together culturally and integrate societies. This process can be described as acculturation, which is the process by which different cultures come into contact with one another and the cultural patterns of one or both groups are influenced, while remaining distinct from one another.

Acculturation has also been taking place for centuries, as travel has evolved and made it easier for cultures to come into contact with each other. First, ocean travel allowed Europeans to explore the world and share their ideas with natives in Asia, Africa, and the Americas. Then steam locomotion, the automobile, and the airplane made it even easier to travel to a distant land and exchange cultures. That is one of the most important things to realize in this new global society. One cannot simply impose their culture on

others but must also learn from other cultures and see what they have to offer. This sharing of culture leads to the sharing of economic, industrial, and political systems. When globalization leads to this network of interconnected societies, it becomes even more important for communication to be clear and effective.

Globalization was also spurred on by the imperialism of various nations over the centuries. Countries such as Britain, France, Spain, Germany, the United States and Japan have all practiced imperialism at some point in their histories. This geographically expansive system allowed them to spread their cultures far and wide. A main part of this acculturation was the spread of various European languages. The dispersion of these languages has helped to facilitate global communication and has allowed cultures to grow together.

English imperialization of countries like India has led to major switches in the languages spoken. In India there exist two official languages. The first is Hindi, a language traditionally spoken in a large region of India. However, despite the fact that there are over 1600 mother tongues in India according to the 1961 census, English, a foreign language of its former colonial rulers is designated as the other official language (Mallikarjun, 2002). However, it is important to remember that, to a certain extent, India chose this fate. After gaining independence from the British crown in the 1940s, India chose to keep English as its official language. Since then, the use of English has been instrumental in the development of India's status as a potential world superpower. It is the world's second most populous country, the most populous democracy, and has the world's fourth largest economy by purchasing power parity and the eleventh largest by nominal gross domestic product (CIA World Factbook India, 2010).

The widespread use of the English language has allowed India to play a major role in the outsourcing of numerous western countries. Many jobs that could have previously been done only in the United States or European countries are now sent to India where the labor is cheaper. India is gaining more and more jobs in the information technology sector as a result. They have large call centers waiting to process calls regarding tech support from English speaking customers around the world.

Overall, globalization was largely brought about by advances in the field of communication. Technological advances have made it feasible to conduct business simultaneously in numerous countries across the globe. The Internet has allowed ideas to be shared across borders that previously had been closed to information as well as across those that had been physically closed. This democratization of information has allowed various cultures to come together in unions and political partnerships. The widespread use of certain languages has also facilitated global communication and helped to bring nations together in the process of globalization. Communication developments have led the way to a global society.

How Communication Media Adapt to Globalization

As the process of globalization continues, it will greatly influence the communication infrastructure and media that are used to transmit messages. These systems will be forced to adapt to the demands of a global society. Certain aspects will rise in importance as others become insignificant. It is a challenge to unite the world and still preserve the cultures of those who inhabit it. The changing communication systems will have to be designed to try to achieve this.

There are seven widely recognized forms of mass media: print, recordings (for example, music), cinema, radio, television, Internet, and mobile communication. Each of these has adapted since their inception to fit into the changing world. They will need to continue to change in a global society to make information available across the planet. Each medium is unique in the way that it presents information to its audience and each will change differently.

The print medium has been considered a mass medium since the invention of the printing press in the 1500s. It revolutionized the way that messages were transmitted over long distances and made books affordable to the masses. Despite the new forms of media that have since emerged, books, newspapers, and magazines continue to be an important part of society. They have adapted to the new technological world by transforming traditional books into e-books that can be viewed on a mobile phone or personal computer. Many newspapers are now offered free of charge, drawing most of their revenue from advertising.

In the future, books will shift even more towards digital distribution. This makes it more convenient for people to read books, as they do not have to physically carry them around. Books will be available at lower prices due to the lack of printing costs and will be easier to distribute across the globe. Newspapers and magazines will also switch to more digital methods of distribution.

The topics of print media will also shift. There will be more and more books about different cultures, and they will be available more widely than ever before. More books will be published to reach a wider audience.. Overall, books, newspapers, and

other print media will adapt and become more digital and will be published about a wide variety of cultures.

Cinema, too, will adapt to the changing global society. Obscure filmmakers use the Internet to get their work out into the public's view, whereas previously only large movie studios had the means to reach a sizeable audience. Increasing technological developments in digitizing movies combined with the increasing affordability of digital storage will make it even easier to share movies around the globe.

The film industry is already seeing an increase in multi-lingual films, and their numbers will continue to rise as more and more cultures become connected. Films will not only be translated into more languages, but they will have multiple languages in them too to reflect the multilingualism of the global society. Their themes will reflect global issues and needs as well as smaller ones.

Music, television, and radio will be affected similarly, with mass distribution and multiple languages. Their themes, too, will reflect global messages and they will be able to reach more people. Costs will drop and content will increase. Many more television programs will be offered over the Internet as opposed to traditional methods such as cable and satellite. Music will become more affordable as companies fight piracy. Prices will be lowered to try to make it less desirable to risk the penalties of illegally downloading music. These changes will all help to allow music, television, and radio to continue to be important media for communication in the new global society.

The Internet will be greatly affected by globalization. Since its inception in the late 20th century, it has generally been a place where ideas flow freely. It has grown incredibly over the past few years. In the year 2000 there were approximately 360 million

Internet users across the globe. By 2009, that number had risen to over 1.8 billion worldwide users, a gain of almost 400% in only nine years (Miniwatts Marketing Group, 2010). The World Wide Web allows people to transfer data and information across the globe in a matter of seconds. Not only is all of this information available, but it also reaches the user at the speed of light due to the use of fiber optic cables. This is particularly important for areas such as Africa and the Middle East, which can use the Internet to bring their economies together with those of the rest of the world and to strengthen their countries. Africa alone has seen a more than 1800% increase in Internet users in the same nine-year time period as mentioned before (2000-2009). However, the percentage of Africans who use the Internet is still a mere 8.7% compared with the 76.2% of North Americans, and it is well below the world average of 26.6% (Miniwatts Marketing Group, 2010). These areas will experience even more growth in the years to come as the Internet is made more affordable and more accessible.

The way the Internet is used is also evolving at a rapid pace. Email is a main part of daily business for most large companies. It provides a way to send messages quickly and at little cost. However it is only textual communication, sometimes including images. In a global society, people interact with many different cultures, so it is important for them to be able to communicate with each other effectively; effective intercultural communication relies not only on text, but also context, which can be hard to interpret from a simple email.

Internet communication in a global society should involve a more complete communication experience. Words are not the only important factor in conveying a message. In many cultures, body language, tone of voice, and words all convey equally

important messages. They show emotion and intent, while words alone can sometimes be misleading. This is why video chatting is gaining so much ground.

Video chatting is becoming more and more popular each day. Most laptops sold today include built-in cameras. Services like Skype, Goober, and other Voice over Internet Protocol (VoIP) clients allow users to make calls and videoconferences across the world to other users for free. This is certainly much cheaper than conventional telephones, where long distance charges make calling for a long period of time infeasible for most people. Skype alone has over 500 million users and is the largest international voice carrier, according to a study by Telegeography (Ricknäs, 2009). These services all promote globalization because they offer user-to-user communication free of charge and provide cheap alternatives to traditional phones when making phone calls outside of their networks.

As the world economies grow closer together and businesses and cultures become more intertwined, this form of global communication will become even more of a necessity. Our intercultural communication, as stated previously, depends on body language and visual cues. Videoconferencing makes it easier for people doing business across the globe to understand each other and to communicate their own ideas. It will become a more common phenomenon as people move further into a global society.

Another new development in communication is the idea of simultaneous collaboration. It can be both time consuming and inefficient when a document or project must be sent back and forth in emails and there are multiple different versions of it. The new concept of simultaneous collaboration has been initiated by Google with their new Google Wave prototype. This allows one to send a “wave” to people, like an email,

except that instead of replying to an email with another email, the recipient can simply reply in the same "wave" which is then updated instantly to all recipients. In Google's own words, "it is equal parts conversation and document" (Google, 2010). It allows people to communicate about and collaborate on a project in real-time across any distance. This type of technology can save time and money for corporations, governments, and ordinary citizens alike. As globalization increases the pace at which everything happens, utilizing a platform like this could be the way of the future.

Many new applications for communication such as web browsers or messaging clients are now open source, meaning that anyone can add to or modify the software. This is very important in a global society with a faster pace, as people don't necessarily have time to wait for software companies to release updates that address problems and improve functionality. They can edit the software to fit their needs and serve their purposes more specifically. In this way, software can adapt faster and work better to help bring people together.

Videoconferencing however is no longer limited to just computers. Mobile phones, such as the newest version of Apple's iPhone, allow users to make video calls to each other from a mobile phone. This is only the latest in a long line of features to be integrated into mobile phones recently. Over the past decade, cell phone usage has exploded. In 1999, only 27% of US citizens used cell phones; in 2009, the same figure had risen to 89% ("Are You obsessed," 2010). The same trend is mimicked far and wide due to the increasing importance of being connected to the rest of the world at all times. In fact, in the US, 23% of women and 32% of men say that they cannot live without their cell phone ("Are You obsessed," 2010).

These handy little cell phones have transformed in the past decades from a piece of equipment used primarily to make phone calls in emergency situations (as it was much too costly to use for other purposes) into a lifeline that connects us with our social, business, and human networks. It has become a necessity for many people to stay connected to everyone else. Doctors and people in other similar professions need to be able to be contacted easily in order to be able to help people and save lives.

One can now browse the web, listen to music, watch videos, play games, and send text messages, all from one's cell phone. Being instantly connected with anyone anywhere is an important way that globalization pulls individuals into its networks of people and keeps them there. Last year (2009), over 4 trillion text messages were sent from all over the world an increase of 23,500% since the year 2000 ("What's happened with," 2010). This shows people's continuous desire to be connected with each other at any given moment in time. This will only increase as globalization progresses.

Like many communication technologies, cell phones are advancing rapidly, and the old models are simply being discarded carelessly. Already there are 1.2 billion handsets sold every year across the globe; unfortunately, only 1 in every 10 of cell phones thrown away every year is actually recycled; most end up in landfills ("The Afterlife of," 2010). While the increased communication is itself both a cause and an effect of globalization, the extra waste has no place in a global society. Most new technological communication devices can be recycled and they need to be recycled in order to move from an industrial society to a sustainable global society.

Globalization and Language

Since the beginning of history, human beings have been communicating with each other. Humans have certainly come a long way since the time of the cave-dwellers in the way that we communicate with each other on a personal level. The SIL Ethnologue tracks the world's languages, and the sixteenth edition, released in 2009, contains information about 6,909 different living languages (Lewis, 2009). Now, one may ask, how is it possible to interact with people speaking so many different languages across the globe? That question will need to be answered in order for a global society to function.

There are an estimated 6.8 billion people in the world according to the United Nations ("Population newsletter," 2009). Each person communicates in a unique way influenced by his or her culture and personal experiences. It is very difficult to unite people in a way that allows them to easily communicate with each other while still preserving the individual cultures of the world. There are many theories on how this can be done and a few of them will be discussed here.

It is not feasible or desirable to replace the various languages of the world with one single language. There are various reasons for this. People identify themselves with their language. They value it for tradition, social prestige, or a number of other reasons. Many expressions cannot be translated into other languages; they are unique idioms and sayings to which people can become attached. In spite of this, there are multiple ways that people of different linguistic backgrounds can communicate with each other.

Pidgin languages are one way that people who speak no common languages can communicate. A pidgin, by definition, has no native speakers, but rather arises out of situational necessity (Meierkord, 2007). Most pidgins are associated with trade, as many

countries throughout the course of history have conducted trade internationally, often without any knowledge of their trade partner's language. Pidgins are used mainly for business, but can sometimes extend past that realm. Increased migration and relationships between people of different cultures can lead to the necessity of the use of a pidgin in a variety of functions.

Numerous pidgins have existed through time and a number of them are still around today. Many of them are extremely simplified or modified versions of other languages, though a pidgin can also employ sounds and body language in addition to words alone. Gastarbeiterdeutsch, or "guest worker German," was employed in Germany during the Gastarbeiterprogramm, or "guest worker program," in the 1960s and 1970s. The shortage of males after the Second World War made it necessary for Germany to invite workers from other countries like Turkey and Morocco. Many of these workers had little or no working knowledge of German, so the pidgin known as Gastarbeiterdeutsch developed, which used simplified rules of the language. Sentences were spoken in the simplest way possible, and without the use of extraneous words that could be confusing. In addition, only the informal pronoun for "you" was used, verbs were not conjugated and instead left in the infinitive, and sentences were often repeated multiple times ("Gastarbeiterdeutsch," 2004). This language is still used to some extent today, even though the guest worker program has long since ended. However, it is not a native language to anyone who still speaks it.

The use of pidgins by adults can lead to their children picking it up from them. When the language is learned as the mother tongue of a child, it can no longer be considered a pidgin, but is rather a creole language. Most creole languages develop from

other languages. Though there are often discrepancies in pronunciation and meaning of specific words, there are usually many cognates from one or more parent languages. Through this process, pidgins can develop into more widely spread languages and become more accepted by society.

One widely known creole is Jamaican Creole, also known as Jamaican Patois. It is sometimes regarded as a broken or incorrect form of English. It features distinct pronunciation differences from Standard English and also has differing pronouns and rules of grammar. However, it is close enough that native English speakers can usually understand Jamaicans without excessive difficulty.

Another important creole is Tok Pisin, also known as New Guinea Pidgin, Melanesian Pidgin, or Neo-Melanesian. However, it is important to note that, despite the name, it is a creole rather than a pidgin since about 1 million people speak it as a native language (Siegel). Tok Pisin is derived from a mix of English, German, Malay, Portuguese, and Papua New Guinea's own Austronesian languages. It is one of the three official languages of Papua New Guinea along with English and Hiri Motu. Although it is the language most spoken in the country, the majority of government documents are in English. Public information campaigns are usually conducted in Tok Pisin and early education is conducted in the language. However, after the first few years in school, instruction is switched mostly to English, the main language of the education system.

It is plain to see here that many pidgins develop through necessity and can evolve into creoles that can unite cultures; however, it is impossible to develop thousands of pidgins to be able to communicate between any two given cultures in the world. This is where the importance of a lingua franca becomes apparent.

Lingua franca is the term generally used to describe a language "which is used habitually by people whose mother tongues are different in order to facilitate communication between them" (UNESCO, 1953). For example, a Japanese speaker may communicate with a French speaker in Germany using German as a lingua franca. Different types of languages can be used as a lingua franca. Two major types are natural languages and constructed languages. It is important to explore both, as both could have a large role to play in the process of globalization.

A constructed language is one which has not evolved naturally, but whose various features have been devised purposefully by an individual or group. One such language is Esperanto. It is the most widely spoken constructed international auxiliary language (Byram, 2004). Developed in the late 1800s in Poland, its goal was to be a language of international communication that would unite people across the world. It was designed to be easy to learn, in order to encourage people all over to learn it. However, under many totalitarian states, it was treated with suspicion. Esperantists were persecuted under the regimes of Nazi Germany, Imperial Japan, and The Soviet Union under the control of Joseph Stalin. Esperantists were suspected of being spies.

The language, unfortunately never quite caught on and is now spoken only by a small community of Esperantists who meet once a year for a world congress, averaging an attendance around two thousand (Universal Esperanto Association, 2008). Esperanto has never been an official language of any country although there are about 1,000 native speakers and about 10,000 people who can speak it fluently (Universal Esperanto Association 2008).

Constructed languages such as Esperanto can be good candidates for a universal lingua franca, partly because they are many times inherently culture-neutral. Esperanto was designed to be used across the globe without any cultural baggage. Nobody would feel as if they are having a culture forced upon them. In spite of this, many people see Esperanto as doomed in fulfilling its dream to be a widely used international auxiliary language, because they believe it cannot compete against English (Berdichevsky, 2007). Perhaps it is too late for a newly constructed language to catch up to the followings of already established languages, which have spread across the globe.

In contrast to Esperanto, a constructed language, it may be beneficial to use a natural language as a global lingua franca. There have been numerous instances of nation-wide use of a lingua franca throughout history. One of the most striking cases is in South Africa.

South Africa is a country with eleven official languages recognized in its constitution ("South africa: fast," 2010). Of those languages, nine are indigenous to the region and two, Afrikaans and English, were introduced during colonization. Afrikaans is a language of Dutch origin and is sometimes referred to as Cape Dutch. In order to facilitate communication between speakers of the various indigenous languages, the government in control during Apartheid stressed the use of Afrikaans across all aspects of everyday life as it was the language used by the white oppressors. However, many people didn't like the segregation and racial injustice of the Apartheid rule and since the end of the Apartheid in 1994, English has widely surpassed Afrikaans in public use, although more people still speak Afrikaans rather than English at home (Meierkord, 2007) ("South africa: fast," 2010).

The necessity of a lingua franca is apparent in South Africa, as white children required to learn an indigenous Bantu language do so in only an educational context, stressing the necessity of the black population to be multilingual. The percentage of the population who choose to learn English is steadily increasing, as a working knowledge of the English language is seen as a "guarantee to socio-economic empowerment by the still disadvantaged black and colored communities" (Meierkord, 2007).

Nevertheless, the use of a natural lingua franca can have several drawbacks when applied to such a large scale. Many cultural conventions differ between native and secondary speakers of a language. Native speakers can take for granted that secondary speakers will understand idioms. Secondary speakers will have problems when they transfer their own cultural idiosyncrasies to their new language, which may not be understood by native speakers. These problems currently exist in South Africa using English as an intranational lingua franca, so they must be taken into account when considering an international lingua franca.

The question that arises when considering an international lingua franca is which language should be used. It becomes apparent that for a number of reasons, the language chosen must not only have a large number of speakers, but must also be a world language. A world language is defined as a language that is spoken internationally with a large number of both native and secondary speakers. However, it is not determined only by number of speakers, but also by geographic distribution and use in international organizations and diplomatic relations (Der Fischer Weltalmanach, 2010). Most world languages are of European origin, due to the historical colonial empires. As such, English, Spanish, Portuguese, and French are all considered to be world languages.

Some stricter sources define a world language as having numerous other properties, including a large number of speakers, a substantial fraction of non-native speakers who use the language as a lingua franca, official language status in several countries, a linguistic community that is not defined by ethnicity, widespread teaching as a foreign language, association with linguistic prestige, use in international trade, use in international organizations, use in the academic community, and a significant body of literature. According to these criteria, the most widespread world language is English, with approximately 1.8 billion total speakers (SIL International, 2009). Other languages such as Spanish and Chinese have a larger number native speakers, but are not as widespread in the realm of secondary speakers. Chinese has a native speaking population of approximately 845 million, which dwarfs English's native population of 328 million (CIA World Factbook China, 2010). However, English is the most widely taught language as a foreign language. Approximately 1 billion people speak English, having learned it as a second language, while a comparable figure for Chinese is only 20 million (Weber, 1995). Additionally, Chinese is spoken by a large multitude of people, but most of them are in China. English has a much wider geographical distribution than Chinese, making it a more qualified world language.

Other world languages have served as a lingua franca throughout various periods in history. French was the de facto lingua franca in Europe for diplomacy for centuries and was only recently overtaken by English as the language of favor after World War II. It was also the lingua franca for the upper class of Russia and Europe in the 18th century.

English however is currently the de facto lingua franca for international business, science, technology, aviation, and diplomacy. It is one of the six official languages of the

United Nations along with Spanish, French, Russian, Arabic, and Mandarin Chinese. However, the UN has been seeming to show a preference towards English in light of its widespread use going into the age of globalization. Many documents are now written exclusively in English to cut costs (BBC, 2001).

It would appear that English is the best candidate for an international lingua franca. However, it can sometimes be a difficult language to learn. There are many exceptions to the grammatical rules and the pronunciation can be hard to pick up. Additional concerns may be expressed that English is already taking over many cultural aspects in various countries. It seems that there is a McDonald's in just about every major city in the world, and US corporations such as Marlboro and Coca Cola are recognized worldwide. They are sometimes seen as imposing their culture on the rest of the world. So, which precautions should be taken to ensure that English, and specifically US American culture does not overshadow the rest of the world?

The answer to that question lies within the cultural context of the language. Many people fear the cultural domination of Western and American society in a globalized world. To help prevent this, one can learn from the failed attempt of Esperanto. Esperanto was designed to be culturally neutral, a goal in which it succeeded, even if it did fail in its main goal to unite the world with one international lingua franca. The closest approximation to culturally neutral English is Basic English.

Basic English, also known as Simple English, has been developed with a core vocabulary of only 850 words and simplified grammar rules. Currently, Simple English is used mainly in English teaching around the world, but was also a key instrument in developing peace after World War II. Simple English uses only simple words and there

are no synonyms. There are 600 nouns, 150 adjectives and adverbs, and 100 verbs and conjunctions ("Education: globalingo," 1945). The grammar rules have been standardized to omit irregularities, of which many exist in the English language.

Basic English is desirable as an international lingua franca because it is simple. Not only that, but the omission of idioms and most culture-specific words helps to eliminate the stigma attached to the English language that it will overpower culture. Basic English is already used in numerous worldwide television broadcasts and radio programs designed to help non-native speakers pick up English.

The instruction of Basic English, however, should not be limited to non-native speakers. It is important for native and non-native speakers to be able to communicate with each other through the use of Basic English. If native speakers go beyond the realm of Basic English and speak mainly in Standard English, then the whole attraction due to lack of cultural baggage is moot. Native English speakers should be taught about Basic English in school as a lingua franca to unite the whole world.

All in all, the use of an international lingua franca is desirable because it will facilitate worldwide communication in a global society. As a constructed language would have a hard time becoming integrated in a society with so many world languages already, it is desirable to use a native language, and English is the most widely spread world language. However, so as not to lose the cultures of other lingual communities, Basic English should be taught in schools and used internationally rather than Standard English. In the end, the languages that are widely spoken will be dramatically altered in a global society.

Conclusion

As this world comes closer and closer to being a global society, communication is rapidly evolving. Technological advances, which helped to set the process of globalization in motion, are now infleunced by it. Globalization and its needs shape the way technologies develop. As conducting business across the globe becomes increasingly common, it is more important to have an infrastructure for efficient, fast, and inexpensive communication around the world. The Internet, mobile phones, print media, television, and cinema are all affected and will continue to be affected. The various methods used to communicate are all moving towards cheap ways to convey ideas at speeds, which, in the past, could never have been imagined.

Additionally, the languages spoken in the world are rapidly being altered. The necessity of a single lingua franca to connect people from all over the world is more apparent now than ever before. Though past attempts to create a lingua franca have failed, English has enough global speakers to possibly prevail. However, careful attempts must be made to preserve the culture of every region on earth.

Globalization is revolutionizing the way that humans live their daily lives. By its nature, globalization will affect even those who do not want to be affected it, and we must take that into account. It is difficult to unite the globe in so many aspects while still protecting the many cultures that inhabit it. Every attempt must be made to take care of these cultures as the process of globalization sweeps across the world.

In the end, people use communication in every second of every day. Every action taken sends a message. Due to globalization, the messages sent are increasingly likely to be interpreted by people who do not share the culture of the sender. Communication

infrastructure and technology along with language usage must adapt to facilitate intercultural communication. Ultimately, in a global society, communication, the very factor that helped to start globalization, will be significantly changed.

CHANGING EXCHANGE RATE REGIMES: MOVING TOWARDS A WORLD CURRENCY

"Globalization . . . has gone hand in hand with an intensification of regional relations, and this leads to the question of exchange rate regimes being widened to the analysis of regional currency areas" (Artus, Cartapanis, & Legros, 2005). Although the ideas of money and currency have been around for thousands of years, never has it been as relevant a topic as it is today. As international relations become more important, there is a need for change in exchange rate regimes. It became evident that change was needed in the 1990s, when there was an outbreak of financial crises in emerging countries, most of which had fixed exchange rate regimes at the time. This has brought many economists to explore the idea of regional currency areas and their potential to be effective, especially since the launch of the euro. Some economists have even pondered the idea of a world currency. As the effects of globalization take hold on the world economy, currencies and exchange rate regimes are moving from a national to a regional, and potentially even a global, level.

Defining Exchange Rate Regimes

Currency is generally thought of as money. In industrialized nations, it generally consists of bank notes and coins, while in less developed societies it may take on other forms, such as livestock; this is known as a barter economy. Currency only accounts for a portion of a nation's total money supply (Goetz vol. 3, 1990). However, when "currency" is discussed in an economic context, "money" is what is usually meant. Money is best defined by its four economic functions. First, it serves as a medium of

exchange. This includes its exchange for goods and services as well as its use as a debt repayment mechanism. Money's second function is as a measure of value and unit of account. This function gives meaning to the value of goods, profits, and losses. Money's third function is to serve as a standard of deferred payments. This function makes loans and credit possible; both of which the world is becoming increasingly dependent upon. Lastly, money provides a store of wealth; it can be stored for later use while remaining a completely liquid asset (Goetz vol. 8, 1990). To carry out these functions, most nations or currency areas have a central bank (there are currently 172 central banks worldwide). A central bank is responsible for regulating the money supply of a nation or currency area, maintaining adequate reserves to support commercial banks (including being a "lender of last resort" during times of panic), and regulating the exchange rate. Governments generally have a significant amount of control over their central banks. Some examples of central banks include the Banque de France in France, the Bundesbank in Germany, and the Federal Reserve System in the United States (Central Bank, 2004). The main focus of this paper will be how governments and central banks manage currency relations in the foreign exchange market; this process is referred to as an exchange rate regime.

Every country faces different economic situations, so there is no single exchange rate regime that is best for all nations. There are a number of factors that influence which one a country will put into practice. For example, capital mobility, adequacy of reserves, external financial vulnerability, political uncertainty, government temptation to inflate, and exposure to exchange rate risk are all significant factors when choosing an exchange rate regime (Cartapanis & Dropsy, 2005). Depending on a country's particular situation,

it may choose to implement a so called "corner solution" in which either a fixed exchange rate regime or a flexible exchange rate regime is applied. Of course, some countries also opt for something in the middle: an intermediate exchange rate regime. A country must thoroughly analyze the pros and cons of each of these types of regimes when making the crucial economic decision of which regime to employ.

The first of the two "corner" solutions is the fixed exchange rate regime. This includes fixed exchange rates, currency boards, and dollarization. A fixed exchange rate exists when one country "fixes" its exchange rate against an "anchor currency." For example, a currency of a small or emerging economy may choose to fix its exchange rate to 4 units per one US dollar. In this example, the dollar is referred to as the anchor currency. The central bank of the emerging country would then maintain the exchange rate by using its foreign reserves (assets held by central banks in foreign currencies) to either buy or sell its own currency in the open market if its value becomes too low or too high, respectively. This is also sometimes referred to as a pegged exchange rate. There also exists a "crawling" peg, which is a plan to gradually appreciate or depreciate a currency in relation to the anchor currency. This is achieved by gradually raising or lowering the exchange rate at which the currency is pegged. A currency board is a monetary authority which is required to maintain a fixed exchange rate. Dollarization goes a step further; it occurs when a country forgoes its currency altogether and uses that of another country. Dollarization can occur with any currency (for example the euro or yuan) but it usually refers to the use of the US dollar. Dollarization is often thought of as an irreversible act (Miotti, Plihon, & Quenan 2005).

There are many arguments both for and against adopting a fixed exchange rate regime. It severely reduces uncertainty, which in turn reduces currency risks on both international trade and transfers of savings. With a peg to a strong anchor currency, the smaller economy doesn't have to worry about the value of its currency dropping to a rate that would be detrimental to its international trading ability. With a fixed exchange rate regime, the smaller currency will also experience lower risk premiums, easier access to international capital markets, and it will have a credible anchor for monetary policy. On the other hand, the exchange rate can become overvalued in the open market. Should this happen, the country will have to spend more and more of its foreign reserves to keep its currency at the pegged rate. Since no country has an unlimited supply of foreign reserves, this cannot be maintained forever and could result in a devastating currency crisis. At the same time, should the anchor currency experience a decline in value or even a minor setback, the effects on the small currency will be magnified. Another key disadvantage of fixed exchange rate regimes is the loss of individual monetary policy. For example, the small country cannot change its money supply to influence inflation because this would change its exchange rate, and that cannot happen in a fixed regime (Artus et al., 2005). Despite these disadvantages, small or emerging economies that are not stable enough to support their own currency in the open market generally adopt a fixed exchange rate regime, because the benefits of stability outweigh the cost of losing individual monetary policy. This type of regime would also be an effective strategy for countries who want to build a stable and credible currency.

In the opposite corner of the exchange rate regime spectrum is the floating exchange rate regime (also referred to as a flexible exchange rate regime). When a nation

lets its currency "float," it allows the value of its currency to be determined freely in the open market without any intervention. However, pure floats are relatively rare; a series of empirical studies have shown that most countries with floating exchange rates intervene on foreign exchange markets to stabilize their currencies (Bénassy-Quéré & Coeuré, 2005). This scenario is what is known as a managed or "dirty" float. In this case, a country sets a price "floor" and a price "ceiling" for its currency and will intervene when necessary to keep its currency within this range. Despite the fact that most floats are not pure, they differ from fixed exchange rate regimes because the exchange rate is allowed to fluctuate in the open market.

As with fixed exchange rate regimes, there are differing opinions as to whether or not a floating exchange rate regime should be implemented. For example, in a floating exchange rate regime, a country has the advantage of maintaining independent monetary policy, which is in stark contrast to a fixed exchange rate regime. Another benefit of a floating exchange rate regime is that shocks can be neutralized by the changing exchange rate. On the other hand, a nation which has a floating exchange rate regime runs the risks of "imported inflation," contraction of international trade in times of currency volatility, and a lack of motivation to implement structural reforms (Artus et al., 2005). With this in mind, floating exchange rate regimes are mainly for currencies which are already strong and stable. Emerging countries often cannot allow their currencies to float because the value of the currency will quickly depreciate in the open market, causing further problems (such as higher prices on exports, making them less appealing to trading partners). In any case, floating exchange rate regimes are best implemented by countries with strong economies and stable currencies. A few examples of countries with floating

currencies include Brazil, Russia, and some Asian countries (Bénassy-Quéré & Coeuré, 2005).

Between these two extremes lie intermediate exchange rate regimes. This includes the idea of a target zone, or "pegged float," in which a currency is allowed to fluctuate within a certain range, referred to as a band, in relation to another currency. This encompasses ideals from both of the corner regimes, because the currency is pegged to an anchor currency, but the band allows it to fluctuate to a certain extent. This is not to be confused with a managed float where the currency is not pegged, just maintained within certain boundaries. Recently, a number of countries have made a change from an intermediate exchange rate regime to one of the corner solutions (Bénassy-Quéré & Coeuré, 2005). This may be in part due to the fact that intermediate exchange rate regimes are generally suggested for countries or areas in a transitional stage. For example

> ASEAN countries could adopt an intermediate exchange rate regime (for example a target zone), in preparation for the creation of a permanent regional currency area in the future. The transitory regime would enable these countries to gain credibility before taking the final step towards a monetary union (Cartapanis & Dropsy, 2005).

In this way, as the Association of Southeast Asian Nations (ASEAN) attempts to move towards a regional currency area, adopting a common intermediate regime would aid in the stabilization of their individual currencies. However, intermediate regimes are not always seen as sustainable in the long run, so they are best left as transitional regimes.

In recent debates over whether it is better to implement a corner or intermediate regime, "empirical studies have rediscovered the implications of Mundell's 'impossible

trinity': only 'corner solutions', that is pure floats or hard pegs (currency board or dollarization), would be sustainable . . . intermediate regimes would be intrinsically weak" (Cartapanis & Dropsy, 2005). Robert Mundell, a Nobel laureate, made many significant advances in the area of international economics in the 1960s. One such discovery was that of the 'impossible trinity,' which is also sometimes referred to as the 'unholy trinity' or 'Mundell's trilemma.' His theory shows that of the following three objectives, only two can be sustained at any given time: perfect capital mobility, fixed exchange rates, and domestic monetary autonomy (Pandey, 2006). If a country implements a fixed exchange rate regime, it has capital mobility and a fixed exchange rate. However, by fixing its exchange rate with another currency, it loses monetary autonomy. At the other extreme, a flexible exchange rate allows for monetary autonomy and capital mobility, but there is not a fixed exchange rate. In an intermediate regime, one can see a bit of all three occurring, which would make it an unstable regime by Mundell's standards. This opinion is not shared by all, as some economists feel that "intermediate regimes can not only be sustainable, but also beneficial for emerging economies, despite their financial weaknesses" (Cartapanis & Dropsy, 2005). This can be seen in economies that are in a transitional stage, such as the ASEAN countries, which need both the stability of a fixed exchange rate regime and the credibility of a flexible exchange rate regime. At any rate, there is no single answer to the question of which exchange rate regime is the "best" one.

A Need for Change: The Currency Crises of the 1990s

There was a rash of currency crises in the 1990s. This included (but was certainly not limited to) the 1994 economic crisis in Mexico, the 1997 Asian financial crisis, and the Argentine economic crisis from 1999 to 2002. Although there are many opinions as to what caused this explosion of crises, most authors can at least agree that "the repetition of international financial crises throughout the 1990s . . . cannot be dissociated from the options adopted in terms of exchange rate regimes" (Artus et al., 2005). If the main cause was the exchange rate regimes, then it is important to investigate the exchange rate regimes that were in place at the time of each of these crises, and how they have changed since then.

Mexico's economic situation seemed ideal with a high economic growth rate, low inflation, and an abundance of capital inflows from foreign investors. In 1987, Mexico implemented a new economic stabilization plan, which led to a single-digit inflation rate for the first time in over two decades. With a wealth of foreign investments, it seemed as if Mexico was faring quite well. Unfortunately this abundance of capital inflows and positive economic outlook encouraged a surge in the demand for credit. This demand came from the Mexican citizens as well as the commercial banks, and lending policies were not very strict. Government spending also increased during this time, which led to further debt. Despite this ever rising level of debt, Mexico's supply of foreign reserves continued to increase due to strong foreign investment in the Mexican stock market. Throughout this time period, Mexico was successfully maintaining a fixed exchange rate between its pesos and the US dollar. In the second quarter of 1994, interest rates in the US began to rise, prompting a devaluation of the peso. This forced Mexico to spend

more foreign reserves in order to preserve its fixed exchange rate. When a presidential candidate was assassinated later in the year, political uncertainty frightened away many foreign investors. Mexico was forced to use its depleting foreign reserves in an attempt to maintain its fixed exchange rate, but this could not go on forever. In December, 1994, the peso was forced to float, which led to steep and rapid devaluation of the peso and the collapse of Mexico's economy (Gil-Diaz, 1998).

The Asian crisis began in Thailand. During the years of 1993-1995, capital inflows to Thailand increased rapidly, which led to a large credit expansion, similar to the situation in Mexico. However, not all of the borrowing was in domestic currency: many firms interested in exporting to the United States began borrowing in US dollars, to which the Thai baht was pegged at the time. In 1996, the US dollar experienced appreciation, and thus the baht was also forced to appreciate in order to maintain the fixed exchange rate, causing foreign reserves to begin to deplete. Exports also began to decline as competition from China grew. For these reasons, market confidence began to wane, causing a steep drop in the value of the stock market and several bank runs. At this time, external factors started to take over: the credit ratings of most banks were downgraded and Moody's ratings of the banking system decreased, culminating in a forecast of a deficit growth of 3% of Gross Domestic Product (GDP) in 1997. Despite measures taken to maintain the fixed exchange rate, such as keeping short term interest rates low in an effort to attract investors, foreign reserves were bound to run out. On June 2, 1997, Thailand was forced to let the baht float, causing rapid devaluation. This started a domino effect, and crises in other nations of the region soon followed. Upon the devaluation of the baht, the peso of the Philippines was put under pressure. Despite an

attempt to lower interest rates, the peso was forced to float on July 11. Malaysia was in a financially similar situation to the Philippines and was forced to let the ringitt float on July 14, only 3 days later. Indonesia was still strong economically when it decided to let the rupiah float on August 14. However, by October its situation was as bleak as Thailand's. The New Taiwan dollar devalued in mid-October, which in turn forced Korea to abandon its won on November 17. In a mere 4 months, the economic systems of this entire region collapsed (Berg, 1999).

Throughout the 1980s, Argentina experienced hyperinflation and severe economic instability until a solution was found in 1989 – a currency board. The currency board went into effect on April 1, 1991 and guaranteed that the Argentine peso would be kept at a fixed exchange rate of one-to-one with the US dollar. From 1991 until 1994, the currency board was considered to be a great success and Argentina experienced tremendous economic growth. At the onset of the Mexican financial crisis in 1994, foreign investors lost confidence in the area and Argentina saw an outflow of capital. Starting in 1995, the US dollar experienced a period of appreciation, which in turn caused the peso to appreciate relative to its trading partners. Despite these setbacks, Argentina was able to maintain its economic growth in both 1996 and 1997. Then, in 1997, the Asian financial crisis began and Argentina entered a recession in the third quarter of the year. By 1998 the crises had also spread to Russia and Brazil. Since Argentina conducted 30% of its trade with Brazil, Argentine exports declined dramatically when Brazil was forced to devalue its currency. By the end of 1999, Argentina requested aid from the International Monetary Fund (IMF); this aid package was delivered in 2000. However, it was not enough. In June 2001, Argentina implemented a new exchange rate

regime: a 50/50 dollar-euro peg which devalued the peso by 7%. This was an unsuccessful attempt to increase international trade. In July, workers' unions went on strike to protest government actions and in November a massive bank run began, prompting the government to put a $1000 per month cap on bank withdrawals. December saw riots, protesting, and supermarket looting. In response to citizen dissatisfaction, the president announced a plan for a new currency, the "Argentino," which would be implemented in 2002 and not be pegged to the US dollar. However, this plan never became a reality, and in January 2002, the peso was allowed to float. Almost immediately, it devalued by over 29% (Hornbeck, 2002).

Opinions are mixed on whether or not fixed exchange rate regimes were to blame for the currency crises in Mexico, Asia, and Argentina. "The breakdown of the Argentine currency board at the end of 2001 has shown that hard pegs can be vulnerable" (Bénassy-Quéré & Coeuré, 2005). Although hard pegs are often thought of as stabilizing for small or emerging economies, they have their pitfalls when the exchange rate becomes overvalued. When foreign reserves were depleting in Mexico and Thailand, it should have been a warning sign that the currency was overvalued. However, these currencies were not stable enough to simply float: this was seen first-hand when the Mexican, Asian, and Argentine currencies were forced to float and all three currencies devalued almost instantly. It is also pertinent to note that exchange rate regimes were not the only cause of these crises:

> Variables related to international capital movements, financial liberalization, foreign currency-denominated external debt, and other factors of financial vulnerability . . . played an important role in currency crises, and thus in the changes of regimes in the

> 1990s. Furthermore . . . the credibility of a peg or a target zone depends on some of these factors of financial vulnerability (Cartapanis & Dropsy, 2005).

In both Mexico and Thailand, the positive economic outlook and high lines of credit hid underlying problems. In Mexico, the lack of credit checks allowed for loans to be granted that never had a chance at being repaid. In Thailand, some of the debt was made in US dollars rather than bahts in an attempt to increase exports. In Argentina the situation was a bit different. Argentina's currency board appeared to be highly effective. Perhaps if the Mexican, Asian, and Brazilian economic crises had not occurred, the currency board would have been a success. This, however, will never be known.

In the decade since its economic crisis, Mexico has worked hard to reduce public debt and control inflation in order to support its current floating exchange rate regime. Although Mexico's declining revenues from oil production present a challenge, there are policies in place to increase tax revenues and thus balance this potential loss. All in all, Mexico's economy is stable, and according to John Lipsky of the IMF, "Mexico has a sustained record of sound economic policies, and has very strong economic fundamentals, and institutional and policy frameworks" (IMF Survey Online, 2010).

Following the economic crisis, Argentina experienced a robust recovery. It saw a GDP growth rate of over 8% for five consecutive years before dropping to 6.8% growth in 2008. During the economic crisis, the poverty level reached an all-time high of 50% but has since decreased to a mere 8.4%. Factors that contribute to Argentina's success have been "a more flexible exchange rate regime, along with sustained global and regional growth, a boost in domestic aggregate demand via monetary, fiscal, and income distribution policies, and favorable international commodity prices and interest rate

trends" (Bureau of Western Hemisphere Affairs, 2009). The government has also built up foreign reserves to cushion against future crises and has improved its tax collection practices. The "more flexible exchange rate regime" referred to is a managed float in which Argentina tries to maintain its exchange rate at around 3.87 pesos per US dollar (Bureau of Western Hemisphere Affairs, 2009).

Mexico is having success with floating the peso and Argentina's managed float regime is also thriving; however Thailand and the other Asian nations have not fared as well. After the Asian economic crisis, Thailand experienced economic growth for only a couple of years before it began to decline again around 2007. Even during its period of growth, the GDP growth level remained, for the most part, below the average growth rate experienced before the crisis. This can be seen in Figure 8 (Bank of Thailand, 2009). As for the other Asian nations affected by the crisis, some of them are also seeing negative GDP growth rates. Figure 9 (Bank of Thailand, 2009) shows that in 2009, Taiwan, Singapore, Hong Kong, Thailand, and Malaysia all had negative GDP growth, and Korea and the Philippines both had growth rates of less

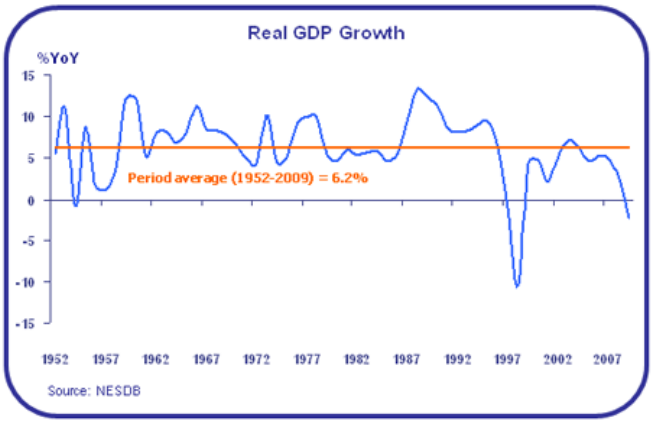


Figure 8: Real GDP Growth in Thailand

Figure 9: Real GDP Growth of Regional Countries in 2009

than one percent. On the other hand, China's growth rate is very high compared to the other countries in the region. Recall that competition for exports with China was one of the factors that lead to the currency crisis in Thailand. It should also be noted that Indonesia, Malaysia, the Philippines, and Thailand are all ASEAN members (Hawkins & Klau, 2005), and Cartapanis and Dropsy have recommended an intermediate exchange rate regime for the ASEAN countries as an intermediary step towards a monetary union, which is perhaps the solution to the economic problems in this region.

Coming Together: Regional Currency Areas and Monetary Unions

The idea of forming a regional currency area (RCA) or a monetary union is certainly not a new one. Monetary unions can be traced all the way back to the Hanseatic Monetary League (13^{th}-17^{th} centuries) and the Monetary Federation of the Rhine (1806-1814) in Europe. Other historic examples include the German and Austro-Prussian Monetary Unions (1838-1867), the Scandinavian Currency Union (1873-1913), the Latin Monetary Union (1865-1914), and the East African Currency Board (1963-1972). Wars and changes of political status are the two main reasons these unions were not successful. Today, the euro zone (formed in 1999) is the most well known RCA, but there are at least three others currently in existence: the East Caribbean Currency area (formed in 1950; the Eastern Caribbean dollar is pegged to the US dollar), the Central African Economic and Monetary Community (CAEMC), and the West African Economic and Monetary Union (WAEMU). Both the CAEMC and the WAEMU were formed in 1945 and are unions of countries that were former colonies of France. Each union has a separate currency, but both currencies are referred to as CFA francs and are pegged to the euro at

the same exchange rate (this follows their previous peg to the French franc) (Hawkins & Klau, 2005). The European Monetary Union (EMU) is thus unique from the other three existing RCAs because its currency is strong enough to float.

As with any currency regime, there are arguments both for and against regional currency areas. The main reasons for forming a monetary union include removal of exchange rate variation between the countries involved, which would in turn increase trade and capital flows between the participating nations. Forming a monetary union also creates a more stable, effective exchange rate and thus less consumer price index volatility. According to Hawkins and Klau, "in many cases such considerations outweigh any possible advantages of using an independent monetary policy to offset idiosyncratic external shocks" (Hawkins & Klau, 1999). He feels that these advantages, at least for small countries, outweigh the major disadvantage of forming a regional currency area: the loss of all individual monetary policy. This opinion is not shared by all; Artus concludes that "the implementation of real regional currency areas in response to globalization and financial instability in emerging or transition countries seems premature" (Artus et al., 2005).

A regional currency is of course not feasible in all areas. In order to facilitate trade, there must be a certain amount of proximity between the nations, in a geographic sense as well as in a financial sense (Artus et al., 2005). The sizes of the economies of nations wishing to form an RCA also play a role in the potential functionality of the RCA: "similar-sized economies . . . are more likely to form a new regional currency, but a very large economy is unlikely to modify its currency arrangement to suit a very small economy" (Hawkins & Klau, 2005). Two economies of relatively the same size are

likely to have similar mindsets in regards to macroeconomic goals, such as inflation targets, as well as practical goals, such as denominations of coins and bills. However, should a group containing only small economies wish to band together, this is not only feasible but could also work to their advantage: "Financial development may be more likely in small countries if they join together into a common currency area" (Hawkins & Klau, 2005).

Questions of the feasibility of forming certain RCAs brings to light Mundell's idea of an optimal currency area (OCA):

> At one extreme, the desirability of conducting an independent monetary policy for stabilization purposes might lead to a huge number of floating currencies – one for every city and town. At the other extreme, transactions convenience would imply a single currency for the world. Mundell sought a balance by suggesting that an optimal currency region is one where factors are highly mobile within the region but relatively immobile in terms of moving outside the region (Hawkins & Klau, 2005).

Mundell thus sought to find an equilibrium between the two extremes and the result was his theory of an optimal currency area, in which a currency should be highly mobile within the area, so as to facilitate trade, but immobile outside the region to avoid exchange rate volatility. Traditional variables that are taken into account when determining if a region meets the qualifications of an OCA include trade openness, relative economic size, and trade sectoral structure. However, some economists feel that these factors are no longer enough in today's emerging world economy:

> The determinants of an exchange rate regime should not be limited to the traditional criteria of optimum currency area (OCA) theory, but should also be extended to

> include new macro-financial variables, such as the degree of financial liberalization and the vulnerability to external financial shocks" (Cartapanis & Dropsy, 2005).

In today's global economy, the vulnerability to external shocks is a valid concern, as can be seen by the rapid spread of the Asian financial crisis in 1997. Other new criteria being considered today include financial openness and depth; external financing structure, needs, sustainability, maturity, and vulnerability; vulnerability to oil shocks; and currency overvaluation (Cartapanis & Dropsy, 2005).

According to Artus, "the European Monetary Union was made up by a group of countries that did not meet the theoretical criteria of an optimal money area" (Artus et al., 2005). Despite this fact, the launch of the euro is generally seen as a success, and even the "beginning of a new era in international monetary and financial relations" (Miotti et al., 2005). This brings up the important issue of competition between the supremacy of the US dollar and the growing strength of the euro. In the short term "it will be very difficult for the euro to compete with the dollar" (Miotti et al., 2005). However, "many authors expect a rise of the euro as an international currency" (Miotti et al., 2005), so it is important to look at predictions for the medium- and long-term:

> A medium- and long-term source of uncertainty has to do with the ability of the European economy to draw nearer to the potential growth rate of the US economy . . . The long-term trend in the growth rate of the euro zone is between 2.5 percent and 3 percent, while that of the United States is close to 4 percent . . . A persistent differential in terms of potential growth works against the strengthening of the euro in the long term" (Miotti et al., 2005).

If the growth rate of the euro zone is not able to match that of the United States, the euro will never see the same strength as the dollar, and perhaps it would be better that way. Historical data shows that "the coexistence of two dominant currencies (as occurred with the pound and the dollar in the 1930s) can be a destabilizing element and lead to unfavorable effects in third countries" (Miotti et al., 2005). Indeed, one such destabilizing effect is the increasing volatility of the euro-dollar exchange rate, which can be seen directly in Figure 10 (Miotti et al., 2005). Should this volatility continue to increase, it will cause further problems for currencies pegged to the dollar or the euro.

	Volatility
1998	5.20
1999	6.47
2000	9.99
Q1 2001	10.89

Figure 10: Volatility of the Euro-Dollar Parity

Given that it would be difficult for these two currencies to exist as equals, Miotti proposes two possible alternatives. The first, which appears more likely, is that both the United States and the euro zone will continue to focus primarily on their domestic affairs without much cooperation. This lack of coordination would "accentuate the instability of the bilateral parity" (Miotti et al., 2005) and the volatility of the two currencies would continue to grow. The second scenario would require the United States and the euro zone to recognize that international economic stability is a concern and "agree to intervene and monitor the evaluation of their exchange rates, and to progress toward coordinating their macroeconomic policies" (Miotti et al., 2005). In this way, the volatility of the exchange rate between the dollar and the euro would decline, giving way to more stability not only in the United States and the euro zone, but also in so called "third nations" whose currencies depend on the dollar and the euro being stable. However, at the current time this more optimistic outcome seems improbable for two reasons. First, since the EMU is

fairly new, the United States is unlikely to turn away from its domestic affairs in order to coordinate with a group of nations whose collective economy is not yet fully developed. The second hurdle is the fact that the EMU does not have a unified political authority, making it difficult for Europe to maintain macroeconomic policies on an international scale. In spite of these challenges, the launch of the euro is, for now at least, considered to be a success.

"The concept of regional currency areas (RCAs) has gained adherents since the successful launch of the euro" (Hawkins & Klau, 2005). The euro has really presented the idea of RCAs as a solution that is not only possible, but also potentially successful. As there are currently only a small number of RCAs, it is difficult to draw conclusions about their success. For example, "in Africa the CFA franc zone has segmented banking systems and only rudimentary regional financial markets. Some countries' wish to foster 'their' financial market can impede regional initiatives" (Hawkins & Klau, 2005). However, the situation in the CFA franc zone is unique in the sense that the regional currency area was established when the nations involved were still French colonies, and the RCA was merely continued upon their liberation from France. Thus it is only natural for some nations to wish to pursue individual financial goals because forming an RCA was not a choice that these nations made for themselves. In spite of this "unsuccessful" RCA, the successful launch of the euro has prompted proposals for numerous other regional currency areas. For example, the Gulf Cooperation Council (Bahrain, Kuwait, Oman, Qatar, Saudi Arabia, and the United Arab Emirates) was formed in 1981 with the goal of working towards a common currency, to be called the Gulf dinar. Currently, as an intermediary step to align their currencies, all are pegged to the US dollar. Should this

RCA form, it would have a large impact on oil prices, as oil and oil-related products account for 70-80 percent of revenue in all of these nations (Hawkins & Klau, 2005).

Another notable example is the proposal of a monetary union for the ASEAN countries, especially following the 1997 Asian financial crisis, which "awakened the East Asian countries to the urgency and significance to develop regional and monetary financial cooperation" (People's Daily Online, 2010). There are a couple of factors favoring the formation of an RCA in Asia, the first of which is "the countries have diversified trading partners so there is no obvious candidate currency to which to link" (Hawkins & Klau, 2005). Hawkins and Klau thus imply that unlike the CFA franc zone, there is no logical anchor for the ASEAN nations' currencies. Therefore it would be a good candidate to stand alone, like the EMU. Yam points out two more factors: "as a long-term possibility, an RCA in Asia 'would create larger and more liquid markets that are less susceptible to manipulation'" (Hawkins & Klau, 2005). With more liquid markets in the Asian countries, they would be less likely to have another crisis of the same magnitude as before because trade would be more easily facilitated between the nations. They would also be less likely to be "manipulated" if they stood together. With the Chiang Mai initiative, the ASEAN+3 nations (the ASEAN nations include Brunei, Cambodia, Indonesia, Laos, Malaysia, Myanmar, the Philippines, Singapore, Thailand, and Vietnam while the "plus 3" refers to China, Japan, and South Korea) have taken the first step towards regional currency cooperation. The Chiang Mai initiative has set up a fund to which the ASEAN+3 nations must contribute to from their foreign reserves, and then in times of financial need they may swap their local currencies with US dollars in

this fund. In this way, participating nations have access to emergency funds in times of need, and thus another regional crisis is unlikely.

Moving Towards a World Currency: Concluding Remarks

With the recent success of regional currency areas, both the feasibility and desirability of forming a world currency are being explored. Surprisingly, the idea of a world currency is not a new one. The idea was first brought up at the Bretton Woods Conference of 1944. However, at the time, the United States was already opposed to giving up its financial supremacy and did not want a global currency in which it would have little, if any, control. Thus an agreement was made: the value of the US dollar would be linked to the value of gold, and the exchange rates of all other currencies would be fixed to the US dollar. In 1971, this came to a crashing halt when President Nixon ended the so called "gold standard" and cut the tie between gold and the US dollar, causing the entire system to collapse. Now, almost 40 year later, proposals of a world currency are reappearing. Zhou Xiaochuan, governor of the Chinese central bank, recently wrote a paper calling for the establishment of a global reserve currency, which would "tip the balance of economic power" (Braund, 2009). Zhou defines the qualities of an effective reserve currency as follows: "it should be anchored to a stable benchmark; its issue should be subject to clear rules so as to ensure an orderly supply; that supply should be flexible enough to permit adjustment as global demand for money changes; and it should not be linked to the currencies of any particular nation or nations" (Braund, 2009). His idea is similar to the structure of the bancor, a suggestion for a world currency proposed by John Maynard Keynes during the Bretton Woods conference. The value of

the bancor would have been anchored to a basket of 30 commodities, essentially making it immune to inflation. Although Zhou's suggestion took most countries aback at first, it has since garnered support from India, Russia, and Brazil.

Globalization has caused many changes in the way countries interact. Growing levels of international trade have made many economists rethink exchange rate regimes. While the corner solutions were once thought of as the best regimes, the outbreak of currency crises during the 1990s showed that even fixed exchange rate regimes, often thought of as the most stable, have their vulnerabilities. The search for a solution has opened many doors, including intermediate exchange rate regimes and the idea of regional currency areas. Especially since the successful launch of the euro, regional currency areas have become a very real option. However, in regards to the "ultimate regional currency," the world is not ready for a global currency. This can be seen by the "fight" for supremacy between the US dollar and the euro: if the United States and the euro zone cannot even cooperate towards macroeconomic policy that would benefit other regions, how could the whole world come together? Although most countries can agree that a global reserve currency anchored to a stable commodity or basket of commodities would be beneficial to curbing inflation and setting a benchmark for exchange rates, merely agreeing on the benefits is not enough for success. Perhaps as the story of the euro continues to unfold and more regional currency areas move from proposals to actualities, it will become clear to the world whether or not a global currency area is feasible. For now though, despite the grip globalization has on the world, the formation of a global currency does not seem realistic.

ENERGY RESOURCES AND THE NEED FOR GLOBAL SUSTAINABLE ENERGY

Energy plays a key role in all nations of the world. Ever since Michael Faraday discovered a means to convert mechanical energy to electricity on a large scale in the 1830s, electricity has played an enormous role in the lives of people, the economies of nations and the environment. Currently, the majority of the energy that is produced globally comes from fossil fuels, such as coal, oil and natural gas. However, the peak of the amount of available fossil fuels in the world has already been passed and there is the need to look into alternative energies and improved infrastructures in order to provide the people of the world with the large quantities of energy they use.

In addition to the decreasing availability of fossil fuels, it is apparent that reliance on these fuels in the past has been detrimental to the atmosphere and environment of the planet. By burning fossil fuels, massive amounts of carbon dioxide and other greenhouse gases have already been released into the atmosphere. Over time, these gases have built up and resulted in a climate change that has increased the average temperature of the planet and could result in the melting of polar ice caps and the further destruction of endangered species and environments.

The worldwide consensus is that renewable energy sources could be the solution to the world's energy needs. Renewable energy comes from resources such as sunlight, wind, rain, tides and geothermal heat that are naturally replenished. Applying renewable energy sources on a global scale is the best way to deal with any form of energy crisis, to begin to deal with the threat of climate change and global warming, and to make the world less reliant on fossil fuels. There is also the need to look into more cooperation in the sharing or energy and the creation of a globalized energy system. A global energy

sharing system could make it easier to generate more energy from renewable energy sources in one area and spread it out to neighboring countries that don't have the resources or geographical location necessary to support an effective system of renewable energy production.

Today, there is a heavy dependence on old energy. Old energy is considered to be electricity that is produced through the transformation of thermal energy into electrical energy (Goetz, 1990). This transformation requires multiple steps or processes in which energy undergoes a series of transformations through various intermediate forms. For the world to move forward, people have to move towards generating "new energy". In new energy production, direct energy-conversion devices, such as solar cells and fuel cells, bypass the intermediate step of conversion to heat energy in electrical power generation. This results in greater efficiency because large amounts of energy are lost in the use of heat energy. Direct energy-conversion devices use electrons as the "working fuel" in electricity generation (Goetz, 1990). This provides more efficient ways of transforming available forms of primary energy into electric power. Many direct energy technologies have existed for over a hundred years; however, until recently, they have not been widely utilized or refined enough to produce adequate quantities of energy. Examples of technologies that are considered to be cutting-edge in renewable energy production, such as the electric battery, fuel cell, thermoelectric generator and solar cell, all had origins in the 1800s (Goetz, 1990). It was not until recent energy crises, such as the 1970s oil crisis, that other technologies – those designed to make wider and more efficient use of the energy in sunlight, wind, moving water, and terrestrial heat (geothermal energy) – have been explored. It is thought that the amount of energy in such renewable and virtually

pollution-free sources is large in relation to world energy needs; yet at the present time only a small portion of it has been developed and harnessed to be used on a global scale.

Current Energy Resources and Their Problems

In the world today, there is great concern over the impact of byproducts of the fuels that are used to obtain electricity. The burning of fossil fuels, such as gasoline, crude oil, coal and natural gas, emits various gaseous compounds that, when in the atmosphere, can result in the creation of acid rain. A build-up of these gases results in a greenhouse effect that is a factor of climate change. Another major energy source in widespread use today is nuclear fission energy. This technology produces radioactive waste that currently cannot be disposed of and that remains dangerous for thousands of years. In addition to the waste problems posed by current energy sources, there is also the threat of eventually running out of fossil fuels and the problem of the interdependency of nations for energy. There is a large amount of debate on these subjects that must be understood in order to determine a way to effectively globalize energy systems and to do so in a renewable and environmentally friendly way.

In 2009, the United States National Academy of Sciences reported that the burning of fossil fuels costs the United States over $120 billion a year in health expenses (Wald, 2009). These costs are direct effects of the air pollution that is a result of energy production and does not include damages from global warming, another direct effect of burning fossil fuels (Wald, 2009). Gasoline engines and steam turbine power plants that burn coal or natural gas emit substantial amounts of sulfur dioxide and nitrogen oxides into the atmosphere. When these oxides combine with water vapor, they form sulfuric

and nitric acids, which cause acidic precipitation. These power plants also release carbon dioxide, which along with methane and chlorofluorocarbons may induce the greenhouse effect and climate changes (Goetz, 1990). Furthermore, fossil fuels are non-renewable resources. Based on current known reserves and consumption rates of these fuels, it is estimated that, as of 2003, there were approximately one trillion barrels of oil remaining in the earth, enough to last 38 years (Massachusetts Technology Collaborative, 2003). It was also estimated that natural gas reserves could only last 59 years and coal reserves 245 years (Massachusetts Technology Collaborative, 2003). As these supplies dwindle, the prices of fuels will continue to increase unless new sources of energy can be found. One alternative source that was long thought to be the solution is nuclear fission.

The chief debate over nuclear fission as a source of energy is the radioactive waste that is a byproduct of the reaction. Nuclear energy also can create other environmental problems, such as groundwater pollution during mining. There is also the widespread concern that a nuclear disaster, such as that in Chernobyl, Ukraine, in 1986, or a terrorist attack on a nuclear power plant could result in large-scale devastation. At the same time, nuclear fission energy is coming to be seen as a temporary solution to climate change due to its lack of carbon emissions.

In no country is this debate over nuclear power more prevalent than in Germany. Currently, Germany is virtually the only country in the world that is strictly opposed to the revival of the nuclear power industry. In 2002, Germany passed the Nuclear Exit Law, which called for the gradual shut down of the nation’s nineteen nuclear reactors by the year 2021 (Theil, 2006). This decision reflects the anti-nuclear feeling that is ingrained in the minds of many middle-aged Germans who had been active in anti-

nuclear demonstrations in the 1980s. The law was passed by the Social Democrat/Green coalition that was in power at the time. Although the Green party was the minority party in this coalition, they were founded on an anti-nuclear platform and exhibited great influence on the Social Democrats to adopt this platform by drawing away their party members. However, this law came with a major problem: 28% of Germany's energy comes from nuclear power (Theil, 2006). If all of these plants are decommissioned, the country will be forced to have a greater dependence on gas and oil imports from Russia (Theil, 2006). Another side effect of this law is that Germany has now cut most of its funding for nuclear research – a decision that has forced Siemens to sell its nuclear division to a French company, moving promising fusion technology research out of the country. As of 2006, 62% of Germans supported the Nuclear Exit Law or had the desire to accelerate the process of reactor decommission (Theil, 2006). However, Germans may have to rethink their position on nuclear energy because times have changed in the energy industry. Since 2006, the price of oil has skyrocketed and increased reliance on imports from exploitive nations, such as Russia and the Middle East, has made energy a national security issue (Theil, 2008). There has also been a change in the governing party of Germany to the Christian Democratic Union (CDU), a more pro-nuclear party. In June of 2008, the CDU proposed to drop the Nuclear Exit Law, and since they won the national election in 2009, this wish may come to fruition. It would not be opposed by the German people, of whom 54% (as of 2008) felt it would be better to leave the reactors up and running (Theil, 2008).

Aside from rising costs of energy imports, Germany has also been politically pressured by its neighbors to reverse its Nuclear Exit Law. Equally green countries such

as Switzerland have continuously rejected similar nuclear moratorium laws, and other nations, such as Belgium and Sweden, have reversed their own exit laws. Neighboring France relies on nuclear reactors for 80% of its electricity and does not see the need to reduce their reliance (Theil, 2008). Germany has also received pressure from the International Energy Agency, which has proposed a 3-point strategy to fight climate change. The strategy includes efficiency improvements, a switch to renewable energies and the construction of 1,300 nuclear power plants worldwide (Theil, 2008). However, even if Germany were to revoke its law, any reversal would only result in allowing current reactors to continue operation. The Germans are not psychologically ready to build more nuclear power plants; they still have the anti-nuclear mindset, but realize that Germany cannot safely and securely fulfill its energy needs, at the present, without the help of nuclear energy.

Types of Renewable Energy

The solution to the world's energy problems is undoubtedly the transition of energy production from nonrenewable sources, such as fossil fuels and nuclear energy, to renewable sources that produce little or no emissions or harmful byproducts. There is a general consensus that the mainstream forms of renewable energy come from wind, hydropower, solar, biomass, fuel cells and geothermal sources. Each of these energy sources has its own individual benefits. They also require different conditions in which to be efficient generators of energy, which may include geographical location, geological features, climate, and available resources. To understand how emission-free electrical

power can be obtained from natural resources, one must actually understand the mechanics involved in obtaining the energy from each resource.

Energy can be extracted from wind through the use of wind turbines. Wind turbines have been used throughout history for transforming wind energy into mechanical energy to do work. However, it wasn't until the twentieth century that they were put into widespread use for creating electricity; this rekindling of wind turbine use can be attributed to the oil crisis in the 1970s (Goetz, 1990). Although there are several types of wind turbines in use worldwide, the two with the most potential for great energy production are the Jacobs and Savonius models. The Jacobs model is by far the most recognizable form of wind turbine. It consists of a three-bladed propeller on a horizontal axis. When it was first created, a single Jacobs model wind turbine could produce one kilowatt of electricity at a wind velocity of 6.25 meters per second, which is the average

Figure 11: Modern Jacobs Wind Turbine - the most widely used for of wind turbine (Richard, 2009)

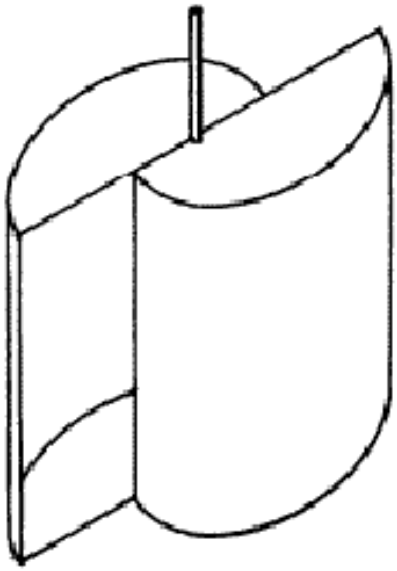


Figure 12: Design of a Savonius Wind Turbine - composed of an oil drum cut in half along the vertical axis and welded together to form an open "s" shape that catches the wind (www.reuk.co.uk)

wind speed at a height of eighteen meters above the ground in the United States (Goetz, 1990). Today, the energy that can be generated by a modern Jacobs model wind turbine can produce upwards of 3 megawatts of electrical power (Richard, 2009). An example of a modern Jacobs wind turbine can be seen in Figure 11. The Savonius model is a much simpler example of a wind turbine. Invented in 1922, it can be constructed from little more than the two sections of an oil drum cut in half vertically and welded together with an offset to create an open "s" shape. The design of a simple Savonius wind turbine can be seen in Figure 12. The Savonius model also produces five kilowatts of electricity at a wind velocity of 12 meters per second, which is a substantial amount when used in large numbers or for small-scale applications (Goetz, 1990). To make wind an effective source of renewable energy large wind farms, or clusters of wind turbines, are often constructed. These wind farms can have anywhere from several dozen turbines to several hundred and are erected in areas that have nearly constant wind, such as near mountain passes or along the seacoast. It has been calculated that wind turbines can have a maximum efficiency of approximately 59%, which is very high compared to other sources, such as steam and gasoline generators, that lose mass quantities of energy in the form of heat. The maximum efficiency is calculated by dividing the energy extracted from the wind by the energy available in the captured wind area (Goetz, 1990). Currently, an efficiency of about 47% is attainable, but as technology advances and the mechanics of the turbines are better refined, this percentage will move closer to the maximum efficiency. Although wind energy is widely available and highly efficient, it does have a small number of downsides. Wind turbines have high initial costs, intermittent operation depending on wind conditions and high maintenance costs. These factors could prevent wind turbines

from becoming a significant factor in commercial power production, especially in developing nations.

Hydroelectric power stations use hydraulic turbines to harness the energy of fast flowing or falling water and transform it into mechanical energy that drives power generators, which in turn produce electricity. Hydraulic turbines are used almost exclusively for generating electric power that can be transmitted through high-voltage power lines to population centers. Some hydroelectric power installations are equipped with turbines capable of producing up to 750,000 kilowatts of electricity (Goetz, 1990). There are two possible locations for building hydroelectric power plants: along the course of a river where dams are built to create reservoirs, or along the coast where tidal plants harness the great amount of energy in ocean tides. The most popular location for building hydroelectric power stations is in river dams. This is due to the fact that a river dam can provide constant electricity, whereas tidal plants can only produce intermittent energy in coordination with the tides. Tidal plants can be

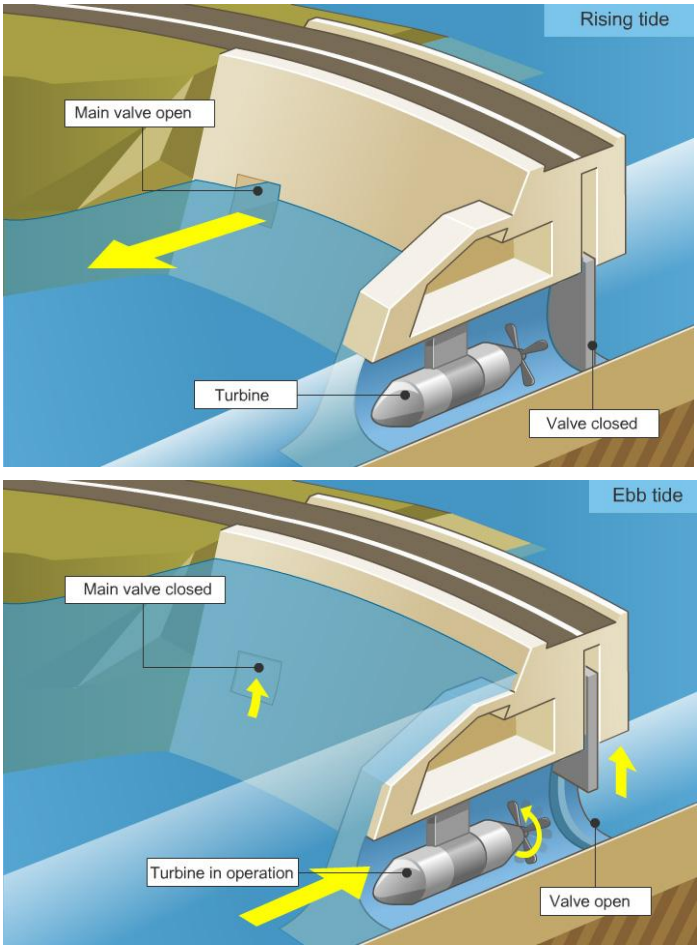


Figure 13: Tidal Energy Plant
Top – during a rising tide, water is allowed to flow through the damn and into a reservoir.
Bottom – as the tide ebbs, a valve is opened, forcing the trapped water through a turbine, producing electricity. (Millier, 2008)

constructed in areas where normal tides run high, such as the Bay of Fundy between the United States and Canada or along the English Channel. Water can flow into a dam-controlled basin during high tide and discharge it during low tide to produce intermittent power. An example of a tidal plant can be found on the estuary of the Rance River in Brittany, France. An illustration of how a tidal plant functions can be seen in Figure 13. This tidal plant produces 240,000 kilowatts of electricity (Goetz, 1990). There is a downside to hydroelectric power: large plants can be operated economically, but the cost of land acquisition and dam and reservoir construction can be very high. However, if you take into account the other benefits of the dams, such as flood control, storage of drinking water, collection of water for irrigation, electricity can be sold relatively cheaply.

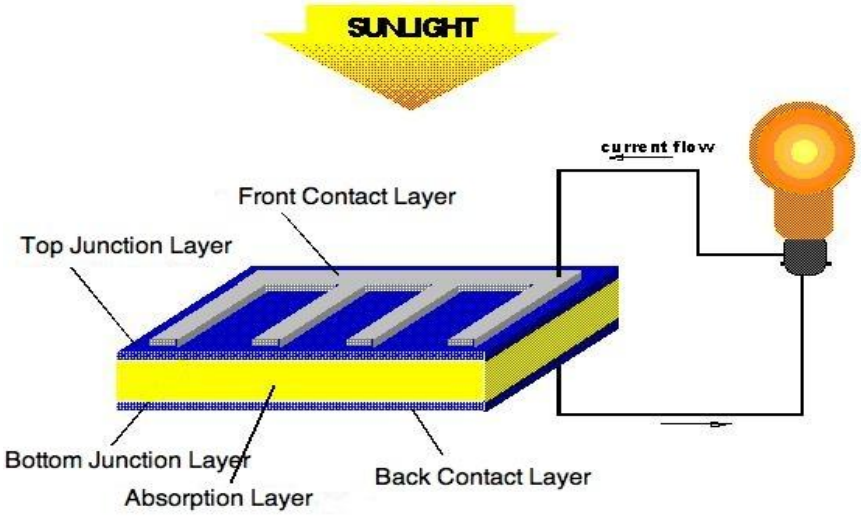


Figure 14: Structure of a Typical Solar Cell (www.tps.ac.th)

Electricity production via solar cells is perhaps the most thought of renewable energy. Solar cells convert energy in light to electricity through the principle of photovoltaics. Photovoltaic systems use radiant energy from the sun to drive electrons across a potential difference at a semiconductor junction in which concentrations of impurities are different on the two sides of the junction (Goetz, 1990). It is a fact of

nature that whenever different materials are placed in contact, an electric field exists at the interface junction. Charles Fritts first used this concept in the nineteenth century. Fritts formed a junction by coating selenium (a semiconductor) with an extremely thin layer of gold, which resulted in the creation of the first electricity-generating solar cell (Goetz, 1990). Solar cells utilize a highly complicated structure of junction, absorption, and electrical contact layers to create an electrical current. An illustration of the structure of a solar cell can be seen in Figure 14. In solar cells, the junction layers form an electric field and a current flows when there are free electrons in the top junction, absorption and bottom junction layers. Absorption of light in the absorber material of solar cells results in energetic, free electrons that move in the direction dictated by the built-in electric field. The flowing electrons of the induced current are collected by the electrical contact layers for use in an external circuit. Solar cells have the potential to create large amounts of electricity, especially when deployed in the form of solar arrays (Figure 15), which large power plants comprised of hundreds of solar cell panels linked together. Single solar cell panels are also beneficial when deployed on small scales in remote regions.

Figure 15: Large Solar Array Located in a Desert (Ecofriend, 2008)

Biomass is biological material derived from any form of plant or animal tissue. Biomass, in regards to energy, generally refers to plant matter that is grown in order to be burned directly for heat or fed to microorganisms to produce biogas that can then be

burned for heating or electricity production. Biomass is only a renewable energy source in that it can be easily produced and is widely available. Biomass use is still better than the burning of fossil fuels. However, because there is still burning involved, it is not emission free. There are also studies researching the potential use of green algae as a sustainable source of bio fuel. Certain microalgae, such as the kind that forms the green scum on the surfaces of lakes and ponds, can grow and mature in just a few days. Mature algae can therefore be harvested daily, unlike standing crops such as corn or soy which can be harvested, at the most, only once or twice each year. The oil produced by algae is rich in triglycerides, which when mixed with an alcohol such as ethanol can produce biodiesel. As an added environmental bonus, waste algae can often be sold as a high-protein animal feed.

Fuel cells may have the greatest potential of becoming a self-contained renewable energy system. In a fuel cell, the chemical energy of a fuel is directly and efficiently converted to direct-current electricity in a continuous manner. The structure of a fuel cell closely resembles that of a battery, but fuel cells can supply electrical energy over a much longer period of time because they are continuously supplied with fuel and air (oxygen) from an external source, while a battery contains only a limited amount of fuel material and oxidant, which

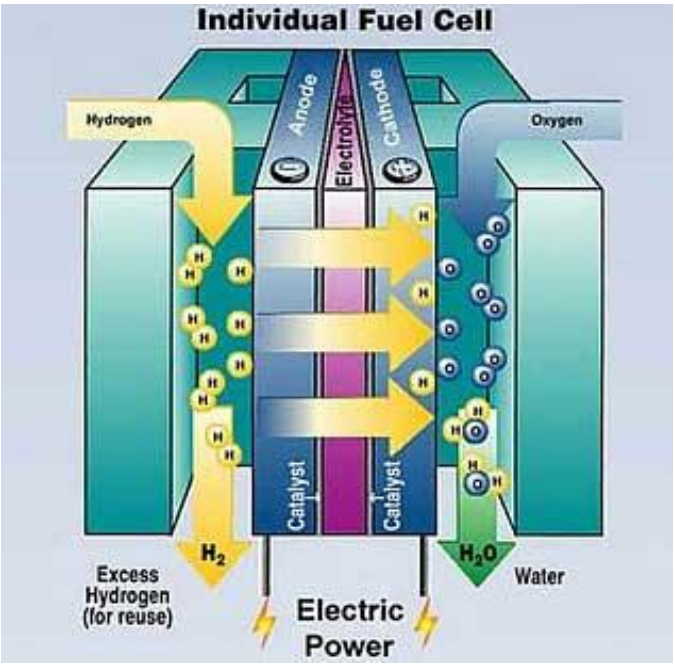


Figure 16: Hysrogen Fuel Cell Structure (Hydrogen on Demand, 2008)

become depleted with use (Goetz, 1990). Within a fuel cell, there is an anode, which supplies electrons, and a cathode, which absorbs electrons. Both electrodes must be immersed in and separated by an electrolyte, which can be either a liquid or a solid, as long as it conducts ions to complete the chemistry of the system. An illustration of the structure of a hydrogen fuel cell can be seen in Figure 16. In order to function, a fuel, such as hydrogen, is supplied to the anode, where it is oxidized and produces hydrogen ions and electrons. At the same time, an oxidizer, such as oxygen, is supplied to the cathode, where the hydrogen ions from the anode absorb the electrons from and react with oxygen to produce water (Goetz, 1990). This is a remarkably important fact supporting the use of fuel cells as a renewable energy source. Since a fuel cell only produces water and electricity from two widely available compounds, it can be called a completely clean source of energy. Couple in the fact that fuel cells have an incredibly high efficiency of about 60%, whereas internal combustion is only about 40% efficient, and one can see a very promising future energy source (Goetz, 1990). Another major benefit of fuel cells is that the chemistry can be reversed; the fuel and oxidizer can be derived from normal water with the introduction of a small amount of electricity. Eventually power modules comprised of this type of high-efficiency fuel cell, used in conjunction with large arrays of solar thermal collectors or other solar power systems to provide the electricity to split the water into its two elements, may be utilized to keep energy cycle costs lower (Goetz, 1990).

Geothermal energy is a renewable source that is very limited in where it can be employed. To create electricity, geothermal energy that flows from the hot interior of the earth to the surface in the form of steam or hot water is harnessed to drive a turbine that

creates an electric current. However, this restricts geothermal plant construction to areas of active volcanism, and within these areas, there is also the restriction that only geothermal reservoirs with temperatures of 180˚C or higher are suitable for power generation. When construction of a geothermal power station is feasible, it can be an effective source of energy. For example, the Geysers power station in California can generate upwards of 1900 megawatts (Goetz, 1990).

In addition to these mainstream sources of renewable energy, there are also those that are currently being researched and developed. For example, scientists are racing to develop fusion technology, which may turn out to be the most effective long-term option for dealing with energy and emissions problems. In fusion technology, the primary energy source is the deuterium ion of hydrogen, which has an abundant presence in ordinary water (Goetz, 1990). In a fusion reaction, two nuclei fuse together to form a larger nucleus. This process releases a large amount of energy. In a nuclear fusion power plant, the heat from the fusion reaction would be used to power steam turbines that would generate electricity. Although radioactive waste is still produced from fusion reactions, the amount of time that this waste remains dangerous is only around 300 years, whereas waste from fission reactions is radioactive for thousands of years. Fusion power would represent a carbon emission free energy source with a less burdensome waste than traditional nuclear energy, which is why it is an attractive option for future energy production.

The amount of energy in such renewable and virtually pollution-free sources is large in relation to world energy needs, yet at the present time only a small portion of it can be converted to electric power at a reasonable cost. The other potential problem with

utilizing these sources is the substantial infrastructure required to both construct the necessary power plants and distribute the generated electricity.

Globalization and Deployment of Renewable Energies

One of the biggest concerns with developing renewable energy systems is the method of globalizing them and distributing them worldwide. Since there are so many different types of renewable energies, they can be deployed in different places to best suit the geography and available resources. There will have to be global cooperation in order to implement any form of worldwide renewable energy system. Each nation will have to utilize its respective geography and whatever natural resources it has in abundance to generate as much energy as possible and share it with those nations that may not have usable geographies or sufficient resources. As developing an efficient global energy network will take time, efforts must be made now to move towards this goal.

Many nations have implemented laws that encourage a transition towards renewable, or cleaner and more efficient non-renewable, energy sources. For example, Germany has passed the Renewable Energy Act, which encourages improved energy efficiency in national energy providers. This law differentiates between technologies so that energy providers that utilize renewable energy sources to receive different guaranteed payments according to the cost of electricity generation. Under the law, producers of hydropower receive between 3.58 and 9.67 euro cents per kilowatt-hour of electricity, whereas producers of solar power can receive between 35.49 and 51.7 euro cents per kilowatt-hour of the electricity they produce because it is more costly (Rickerson, Sawin & Grace, 2007). The main purpose of the law, however is to

encourage all companies involved in renewable energy production business to invest in developing and generating renewable energy sources and to promote and support small and medium sized energy firms. Brazil is another country that has implemented a different type of program. This new program encourages the production of Ethanol fuel from sugar cane, a largely abundant resource in Brazil. As a result, sugar cane Ethanol is responsible for 18% of automotive fuel in Brazil and is also widely available in the United States. There are also programs in some nations to improve energy efficiency and lower energy consumption on a consumer basis. For example, the United States Energy Department runs a program called "Energy Star." This program sets the efficiency standards for nearly all products that use energy. Products that bear the "Energy Star" label are guaranteed to be among the most energy efficient of their kind. It is believed that if the United States government were to implement this initiative globally, a globalized standard for the efficiency of household appliances could be created, and products would have to bear the label. Reducing final demand by creating more energy efficient products could be the first step in the global effort to reach sustainable energy. Globalizing "Energy Star" would provide a framework for continuously raising performance standards and eliminating energy waste from products (Lees, 2007).

Wind energy is probably one of the renewable energy resources that has the greatest potential for worldwide expansion. Following the energy crisis of the 1970s, the number of wind energy systems in use greatly increased in the 1980s. As early as 1984, the output of all wind farms in the United States exceeded 150 million kilowatt-hours of energy (Goetz, 1990). However, this was only 1/100,000th of the total power generated in United States in that year (Goetz, 1990). There are vast areas of land on which wind

farms could be constructed. Wind turbines such as the Savonius model could be vastly distributed and utilized in developing and third world countries, because this particular model is simple to build and has a very low initial cost. Currently, the utilization of wind power is growing at a rate of 30% per year. As of 2009, the worldwide installed capacity of wind power was 157,900 megawatts, with the countries in Europe, Asia and the United States being the largest contributors (Reve, 2010).

Another huge potential deployment of wind energy is offshore wind farms. This is a subject that is currently under serious discussion in the Cape Cod region of Massachusetts. In the year 2001, the energy firm Cape Wind proposed to build America's first offshore wind farm far off the coast of Massachusetts. The farm would consist of 130 wind turbines that would produce 420 megawatts of renewable energy (Project at a glance, 2009). The farm would be able to produce three quarters of the electricity required by the Cape Cod region of the state, as well as the two large islands of Nantucket and Martha's Vineyard. The company performed numerous environmental assessments and impact estimations to determine the effects that the wind farm would have on the environment. It was estimated that Cape Wind would reduce greenhouse gas emissions by 734,000 tons per year, as well as reducing the importation of foreign oil to the region by over 113 million gallons of oil per year (Project at a glance, 2009). This would remove a small but helpful portion of the United States' dependence on the import of oil from foreign nations, which has recently become an economic and national security burden. The wind farm also had to be assessed for its effect on shipping and wildlife. With the turbines being spaced six to nine hundred yards apart, there will still be plenty of navigational room for shallow draft boats that pass through the area. A final estimate

puts gives a savings of approximately $25 million per year for the New England electricity market (Project at a glance, 2009).

Similar offshore wind farm initiatives have been undertaken in Europe. In 2009, Europe added an offshore wind power capacity of 577 megawatts, which is 54% more than the 377 megawatts producing turbines that were installed the year before (Reve, 2010). According to data published by the European Wind Energy Association, eight new wind farms (199 wind turbines) came into operation in the seas around Europe in 2009, and in 2010 another 10 wind farms will be completed, for additional 1,000 megawatts (Reve, 2010). Today, Europe is the world leader in offshore wind energy with 828 wind turbines installed in 38 wind farms located in nine countries, generating a total of 2,056 megawatts. It is thought that offshore wind may provide as much as 17 percent of the European Union's electricity demand by the year 2030 (Reve, 2010). Hopefully the United States will soon follow suit with projects such as that proposed by Cape Wind.

Hydropower is currently the most widely used source of renewable energy. In industrialized nations, almost all possible locations for generating efficient hydroelectric power have been utilized. As of 1990, 75% of potential waterpower sources in the United States had been developed (Goetz, 1990). However, in Alaska, Canada, Russia or developing nations in the regions of the Himalayas, Africa, and South America, only around 23% of potential waterpower sources have been developed (Goetz, 1990). Hydropower costs a lot to implement but pays off over time and can provide cheap energy when it is widely used, in regions such as the Pacific Northwest United States, which have large water sources. With the help of all nations, a vast amount of

undeveloped water energy could be utilized and shared throughout the world and could help developing nations progress.

However, there is a downside to hydropower. The biggest and most obvious impact of implementation of hydropower is the flooding of large areas of land that could otherwise have been used for agriculture or housing. Reservoir construction across the world has threatened rare ecosystems and forced the mass relocation of people, such as in the case of the Three Gorges Dam in China. The La Grande Project in northern Quebec has also resulted in the submergence of more than 10,000 square kilometers of land (Environmental impact of energy production, 2009). There have also been recent studies that suggest that the construction of large dams can actually cause a huge influx of greenhouse gas production. It is believed that:

> The decaying vegetation, submerged by flooding, may give off quantities of greenhouse gases equivalent to those from other sources of electricity. If this turns out to be true, hydro-electric facilities…that flood large areas of land might be significant contributors to global warming (Environmental impact of energy production, 2009).

The vegetation may also raise the levels of water-soluble mercury in the reservoir water by extracting mercury from the rocks underlying the reservoir (Environmental impact of energy production, 2009). This could then pose a serious health risk if it enters the food chain through fish that live in the reservoir. The final downside to hydropower is environmental due to changes in river silt deposits and fish migration.

Solar power can be easily and just as widely deployed as wind energy. Nearly every country, except those located in the extreme northern and southern latitudes and exposed to lower levels of annual sunlight, can utilize solar energy. Although much more

expensive than the Savonius wind turbine, solar panels could be easily distributed to remote and developing regions. In fact, Kenya has the world's highest household solar ownership in the world (Goetz, 1990). Recently, the annual manufacturing output of the photovoltaic industry reached 6,900 megawatts. Solar energy in the form of photovoltaic power stations has increased in popularity in both Germany and Spain and solar thermal power stations, that utilize the suns heat to excite electrons into a current, are widely present in the United States and Spain. In fact, the largest solar thermal power station generates 354 megawatts of energy and is located in the Mojave Desert (Goetz, 1990).

By far the most promising form of renewable energy that is being developed is fuel cell technology. This technology has the potential of using very simple resources for creating an almost self-contained cycle of energy production. By coupling the fuel cell with a solar power station and an available source of water, vast amounts of energy could be produced on demand. When taking into account that the process is highly efficient and completely clean, it becomes clear that this technology will play a large role in the future of energy production in a more globalized world.

Globalization of energy has already begun with the exchange of fuels and the connected infrastructures of neighboring countries. However, as of 2006, only 18% of energy that was consumed around the globe came from renewable resource technologies. Of this percentage, 13% originated from biomass, 3% from hydroelectric power and the remaining percentage from mainstream renewable energies. Similarly, the renewable energy share of electricity production was also 18%. Of this percentage, 15% was hydroelectric and the remaining 2% came from new mainstream renewable energy sources. Although the percentage of world energy that is produced from renewable and

sustainable sources is rather small, it is clear that as these renewable technologies become more sophisticated and efficient, they will need to be distributed on a worldwide scale and the infrastructure connecting them will have to be one of a globalized nature. This is becoming more and more important as the carbon footprints of the industrialized nations are increasing and the oil supplies of the world are depleting. Sometime in the near future, the nations of the world will need to undergo large overhauls of their energy networks and become more ecologically and environmentally conscious.

SUSTAINABLE AGRICULTURE IN A GLOBAL SOCIETY

It is undeniable that the environment will one day be unable to sustain the global population, which cannot increase indefinitely. The development of a global society has aggregated the world's resources into a single pool, which in turn regulates the global population as a whole. Due to the vast interconnections between nations, most of which are now dependent upon one another, classic competition for resources has become outmoded. As society draws from the resource pool, it increases itself in biomass, and as it does so, it subsequently further depletes the resource pool. If society is to sustain itself on Earth's environment, it must change its present habits.

Resources are finite. A population can only be sustained to its approximate carrying capacity (denoted by the letter K), at which point the population must either level-off or decline. At carrying capacity, a species does not thrive; food becomes scarcer per capita, competition for other resources intensifies, and disease is more easily transmitted due to a higher population density. For most species, this is a normal cycle. Some species, known as r-selected species, follow an opportunistic growth curve, meaning they quickly burn through resources and erratically fluctuate in size. In other species, a local population will generally increase to carrying capacity, at which point it will oscillate closely around this upper limit. These more stable species are referred to as K-selected species. When an event occurs to decrease the population size of a K-selected species, such as epidemic or natural disaster, the population will regenerate back to this equilibrium, which is regulated mainly by resource availability. It is a constant, density-dependent cycle by which most mammals, including humans, are regulated.

Despite their alignment with K-selection, however, humans are unique. This growth cycle may be observed in some small populations, but the human species has been developing into one large global population, progressively more interconnected and capable of amplifying local carrying capacities through external aid. As advances are made in medical sciences and agricultural methods, the world population increases seemingly without limit. There is, however, a limit, and unless the resource pool is somehow multiplied, humans will be subjected to this limit.

To determine what must be done to regain sustainability, one must first consider the various aspects of resource depletion. First of all, there is the natural consumption of resources. Speaking strictly agriculturally, resources are consumed and renewed in a continuous cycle. The only problems presented to global population by this cycle are the distribution of resources and the amount of resources available at one time, the latter of which decreases per capita as the population increases. Then there is the distinctly human element of environmental harm. This comes about in several ways, including over-cultivation, the production of some synthetic materials, and pollution. The environment can take only so much abuse before it is rendered infertile. For example, the overuse of a plot of land in agriculture will cause erosion and decrease soil fertility, which in turn reduces the production of crops. Processing materials in such a way that reduces biodegradability, for all intents and purposes permanently removes resources from the environment – plastics, for example, not only draw from the environment but also affect it by harming wildlife. Chemical waste also harms wildlife, and it’s toxicity decreases soil fertility. All of these factors deplete resources by either directly removing them or by

decreasing habitability and resulting in negative feedback loops (or, self-deteriorating cycles).

There are ways to reduce problems faced by limited resources. These involve changing current industrial and personal habits. In terms of agriculture, cultivation must be made more efficient in order to increase the yield of products while retaining soil fertility and usability and removing the need to expand croplands by such means as deforestation. The explosive development of the aquaculture sector, which involves the production of fish in contained fisheries, requires moderation and standards before it exhausts the oceans. Due to the increasing range of environmental and ecological consequences, the damage caused by one nation is not contained within that nation, and global policies are therefore necessary to ensure the sustainable growth of the world population. For longer-term sustainability, it is essential that the controversial topic of population size be addressed. Although a carrying capacity exists, there are ways to moderate the growth of human society and enable sustainable agricultural development across the world.

Sustainable Agriculture

Food and water are perhaps the most important resources. Humans began as hunter-gatherers, which sustained them until the advent of crop domestication during the Neolithic revolution approximately 10,000 years ago. Rising populations and an increasing level of cultivation eventually incited the development of full-blown agrarian civilizations, which was a more effective way of living for the progressing villages and settlements (Pringle, 1998). Today, agriculture consumes a significant amount of the

world's land resources and provides for a global population. Although extensive cultivation has helped to sustain people throughout the world, it has introduced several environmental problems. First, some agricultural methods are ultimately more harmful than helpful. For example, the excessive practice of a method called shifting cultivation serves only for a short term before reducing land fertility and usability. Second, various means of expansion of agricultural lands have led to deforestation and desertification. Thirdly, the widespread cultivation of genetically modified (GM) crops without regulation reduces biodiversity and affects ecological systems. These environmental consequences have negative feedback effects on the growth of food.

Agricultural Methods

Some methods of cultivation that are sustainable in moderation are often unable to be used in such a way by growing communities. As observed by Anthony Young (1998), "Growing populations will lead to increasing pressures on a finite land resource, so people will be forced to exploit land in ways which cannot be sustained" (p.253). In shifting cultivation, land is used for a few years, then left to fallow for several years in order to recover and regain fertility before being used again. This is generally a sustainable agricultural method, and while the land is left to fallow, its natural successive vegetation is often used for materials and orchard type trees are often planted to stabilize soils while also providing fruit. However, as the need for food increases, the length of the fallow decreases by necessity, which leads to the degradation of the land and the eventual inability to use it. Cropping at more frequent intervals depletes soil nutrients and seed banks, leading to an inability for succession to take place and also an inability to cultivate. Soil erosion is also an effect, as the over-harvesting and constantly bare land

does not allow soil to be held firmly by roots. Land degradation also results from misuse of the slash and burn method, which goes hand-in-hand with shifting cultivation. This technique involves the preparation of land for cultivation through burning and, when used properly, can actually increase soil fertility. When used extensively, however, slash and burn leads to the inability of the land to recover. The soil erosion, moisture loss, and nutrient loss brought about by deforestation and over-cultivation, on top of other human-induced environmental stresses, eventually lead to desertification, which is the complete infertility for all vegetation and the creation of dunes.

Once desertification occurs, farmers must move to new lands to be able to support the community, but when farmers who have already caused such land degradation in one area move to another, they only increase the area of desertification and worsen their own agricultural problems. In many arid and semi-arid areas, "nomads moving to less arid areas disrupt the local ecosystem and increase the rate of erosion of the land. Nomads are trying to escape the desert, but because of their land-use practices, they are bringing the desert with them" (USGS, 1997). However, contrary to popular belief, desert lands can be reclaimed. Various methods of stabilizing soil and increasing moisture have been utilized in the past – for example, following the Dust Bowl of the 1930s in the American and Canadian Great Plains, desertification was reversed and better farming methods were implemented to keep it from recurring. During the process of desertification, however, farming is severely affected – "The Sahelian drought that began in 1968 was responsible for the deaths of between 100,000 and 250,000 people, the disruption of millions of lives, and the collapse of the agricultural bases of five countries" (USGS, 1997). Although drought is often a factor in desertification, it is well known that drought-stricken land is

easily renewable, since droughts are common in arid and semi-arid regions; poor farming practices are both a cause and accelerant of desertification.

Land Expansion

On top of overuse, land expansion is also a critical means of land degradation. As the availability of cultivable land decreases, forest land and hillsides are used to expand. The consequences of this are severe, as it can decrease land availability over the long-term. As shown in the following figure, land area for agricultural use (not only pertaining to arable land) has expanded significantly over the past 40 years, with the extension of arable land, or land that is suitable for cultivation, making up approximately a quarter of this expansion.

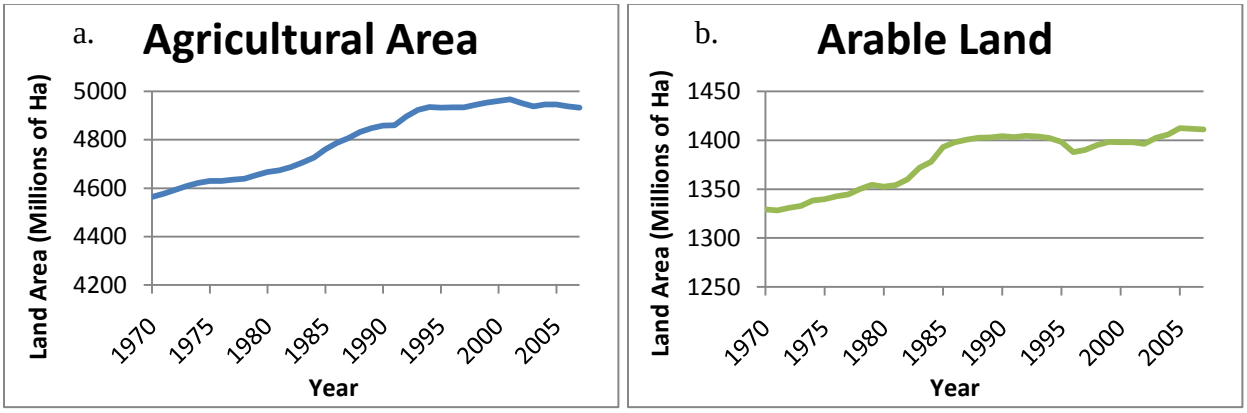


Figure 17: a. Expansion of agricultural area from 1970 to 2007. Includes the sum of the areas under arable land, permanent crops, and permanent meadows and pastures. b. Expansion of arable land from 1970 to 2007. Includes land under temporary crops, temporary meadows for mowing or pasture, temporarily fallowed land and market and kitchen gardens; does not include potentially cultivable land.(FAO, 2010).

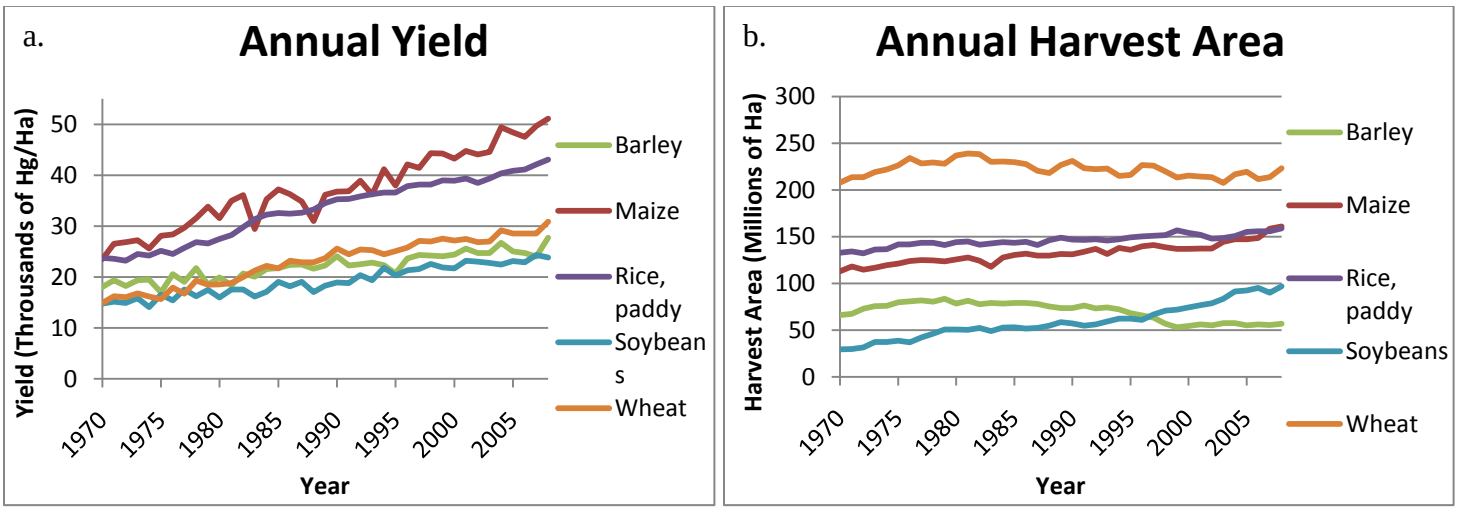
Permanent crop lands have also increased by approximately 45 million hectares (Ha). Overall, the world contains 3,000 million hectares of arable land, and approximately half of that is currently used for agriculture. The non-use of the second half is attributed in part to poor conditions in relation to water, such that intensive land management would need to exist and considerable investments would need to be made in order to cultivate

(Sven-Olof Ryding, 1998). To cultivate cost-effectively, therefore, lands are increased through other means. In developing countries, expansion of arable lands through deforestation is the most feasible method for increasing cultivable area under the country's possession. A prime example is the situation in Malawi. In the 1960s, the small African nation was home to 3.5 million people. Continuous maize production provided for the population and there was no serious erosion. By 1975 it hosted a population of 5 million, arable land was fully occupied, and cultivation had extended up hillsides. There was evident rill erosion (the formation of channels in cultivated soils due to runoff) as well as gully erosion (deeply eroded channels that cannot be remedied through tilling) in valley-floor pastures. In 1995 the population had increased to 11 million, in part due to refugees. Forests had been widely invaded for cultivation and crop yields had declined since 1980 due to low fertilizer use and soil fertility decline. By this time, imports and food aid supported 20% of the nation's food requirements. Resource potential was declining further due to the erosion and reduced soil fertility; the country was past its sustainable limit (Young, 1998). Since then, Malawi's agricultural dilemma has been, for the most part, taken care of through the implementation of more sustainable methods. In 2007, the country produced a surplus of 1.5 million tonnes of maize, with the population as a whole only requiring approximately 2 million tonnes. This level of production, which was 73% higher than the average of the previous five years, was attributed to increased fertilizer use, which was a result of government-subsidized fertilizers (Malawi, 2008). In relation, the United Nations Food and Agriculture Organization (FAO) has stated that if other farms in sub-Saharan Africa do not increase fertilizer usage and practice sustainable land and water management, they "will seriously jeopardise their

long-term food security, productivity and incomes, while environmental degradation will accelerate" (Malawi, 2008).

Land Management

Environmental damage is not the only problem faced in agriculture. Land management in regards to what is grown and how it is grown is an important aspect when it comes to increasing the efficiency of cultivation. Land expansion is not the only method of increasing production; in fact, the better way is to improve the yield of crops. Over the past 40 years, world increases in yield have been made in four of the major cereals (barley, maize, rice and wheat) as well as soy beans and potatoes, but of these, only potato and barley cultivation have seen a decrease in harvest area (Figure 18).



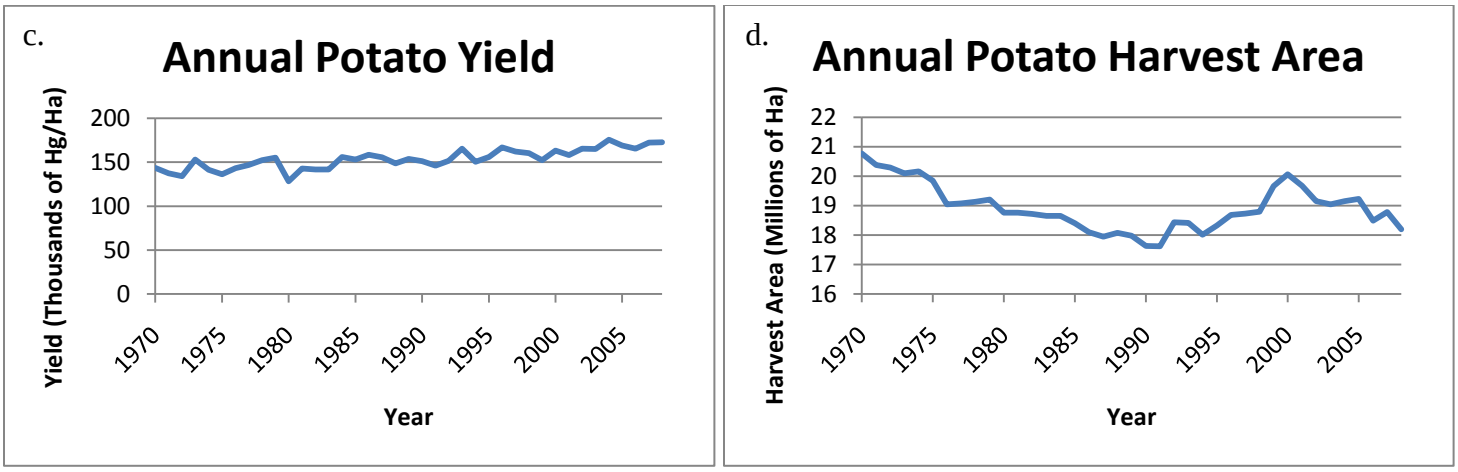


Figure 18: a. Annual world yield of selected crops in thousands of hectograms per hectare of harvest area. b. Annual world harvest area for selected crops in millions of hectares. c. Annual world potato yield in thousands of Hg/Ha. d. Annual world potato harvest area in millions of Ha.(FAO, 2010)

As seen above, the increased yields per hectare for the four cereals, soybeans, and potatoes are significant. However, the upward trend of increased harvest area for four of the six crops is not sustainable over the long-term. The decreasing harvest area and increasing yield of potatoes is likely due to where the vegetable is cultivated – mainly Europe and Southeast Asia. However, it is not widely cultivated in Africa, where cereals are the main food staples (FAO, 2010), and African nations require some of the highest yield improvements due to limited cultivable land. Irrigation typically produces twice the yield of rain-fed crops, but in developing nations with limited water resources, other methods must be put into place to increase yield. In Bangladesh, a decade of improvements in land management led to a 25% rise in cereal production entirely due to the raising of crop yields. Unfortunately, the growing population worked against this increase (Young, 1998), but the country would have been much worse off if the improvement in production had not been made; the area of cultivation could no longer be increased, and therefore more imports on top of the previous production rates would have had to sustain the population.

Not only must yield increase versus land increase be taken into account, but also the assumption that all cultivable land is used for food production. Agriculture also includes the production of commodities such as cotton, tobacco, coffee, and medicinal plants, along with the (often illegal) cultivation of drugs. Economically, agricultural exports provide many developing nations with their highest source of profit – a result of the extensive cultivation of 'cash crops' – and this profit fluctuates with global demand. This can cause problems for developing nations when the supply of a crop exceeds the international demand; first, farmers of these crops are faced with the inability to cover production costs, and second, many of these crops are perennial and it is difficult to switch to another type of crop. This has been witnessed in the Global Coffee Crisis, in which the global price of coffee has dropped due to a level of coffee production that is outpacing international demand: the annual rate of increase in coffee production averaged 3.6% in 2002, while demand increased at only 1.5% (Néstor Osorio, 2002). Aside from the economic aspect, the cultivation of non-food crops takes land area away from the cultivation of food-crops; in some developing nations, this leads to the increased need to import food to feed the population.

Ecological Ramifications

Environmental damage, like land degradation, is only a small component of the feedback loop created by human disturbance. As observed in an article on sustainable development of the Boreal Forest, "humans are an integral component of ecosystems, just as the products of ecosystems are critical to social systems.… We define a sustainable system as one that maintains the same general structure, processes, interrelationships, and patterns of disturbance" (Chapin & Whiteman, 1998). Human activity often undermines

structure, processes, interrelationships, and patterns of disturbance, which by this definition decreases the ecological sustainability.

Structure is perhaps subject to the most alteration. Of the 14 biomes, 9 have seen 20-50% transformation into croplands, which typically leads to a reduction in biodiversity (Duraiappah & Naeem, 2005). Reduced biodiversity has a large impact on human society, especially in developing nations, as it is something that provides many sources of symbiosis for human agricultural activities.

> Poor farmers often do not have the option of substituting modern methods for services provided by biodiversity because they cannot afford the alternatives. And, substitution of some services may not be sustainable, and may have negative environmental and human health effects (Duraiappah et al., 2005, p.41).

Biodiversity is also negatively affected when ecological processes are disturbed. This happens when, for example, an invasive species is introduced into a new habitat due to the importation of crops. An invasive species is one that thrives when presented to a new habitat in which it was not living previously; local species generally have no defenses against this new species, which is therefore able to drive competitors to or near extinction and upset the balance of the community.

Interrelationships are affected by the introduction of certain GM crops. In this case, GM crops intended to either be directly resistant to pests (Bt crops) or better resistant to herbicides such that more can be used to kill pests (HR crops) affect the ecology of the area by disturbing wildlife. Although not all GM crops are bad, some can have unexpected outcomes. In China, the widespread cultivation of Bt cotton crops in the late 1990s took care of the bollworm pest, which had been destroying crops. However,

the decimation of the insect's population allowed its competitor, the mirid bug, to take its place, since fewer broad-spectrum pesticides were being used and the mirid bug is resistant to the Bt toxin, which the crops had been modified to produce. They found that "numbers of mirid bugs (insects of the Miridae family), previously only minor pests in northern China, have increased 12-fold since 1997," and Kongming Wu, an entomologist monitoring the situation, stated that "Mirids can reduce cotton yields just as much as bollworms, up to 50% when not controlled" (Qiu, 2010). In fact, farmers began using pesticides again in order to kill the pest, and it is expected that they will eventually return to using the level of pesticides they used prior to cultivating the GM crops – the very reason they began using the modified crops in the first place, since the pesticides caused environmental damage and were poisoning people. On top of that, "the insects are also emerging as a threat to crops such as green beans, cereals, vegetables and various fruits" (Qiu, 2010), meaning that the farmers ended up with a bigger problem than the one with which they began.

Destroying pests not only affects the population of the pests themselves but also whatever animals prey on them. Through a chain reaction, an entire ecosystem can be thrown off. When this happens, the ecosystem loses biomass production, leading to negative effects on human development. Not only can wildlife be affected, but the reduction of biodiversity in the cultivated plant itself can have harmful outcomes. Diversity within a species greater enables its survival following a disturbance, since some individuals may fare better than others due to differing traits.

Resistance to Improved Technologies

Despite some ecological effects, GM crops actually have a great deal of potential in solving yield problems – as long as they are tested and regulated as to have the least negative ecological impact – and interestingly most of the resistance to agricultural biotechnology is unrelated to the ecosystem. The main concerns among the general populous are health-related. There is a great deal of fear that GM foods are poisonous or have other negative health effects. As observed by Dr. Norman Borlaug in 1993, "they claim that the consumer is being poisoned out of existence by the current high-yielding systems of agricultural production and recommend we revert back to lower-yielding, so-called sustainable technologies" (Hennigan, 2010), despite the fact that there has been no real evidence showing negative health consequences from the already-implemented GM crops. Borlaug went on to say:

> Biotechnology helps farmers produce higher yields on less land. This is a very environmentally favourable benefit. For example, the world's grain output in 1950 was 692 million tons. Forty years or so later, the world's farmers used about the same amount of acreage but they harvested 1.9 billion tons — a 170% increase! We would have needed an additional 1.8 billion hectares of land, instead of the 600 million used, had the global cereal harvest of 1950 prevailed in 1999 using the same conventional farming methods … If we had continued practicing conventional farming, we would have cut down millions of acres of forest, thereby destroying wildlife habitat, in order to increase cropland to produce enough food for an escalating population. And we would have to use more herbicides in more fields, which would damage the

environment even more. Technology allows us to have less impact on soil erosion, biodiversity, wildlife, forests, and grasslands (Hennigan, 2010).

Nonetheless, many environmental groups, governments, and people are against GM crops, and many consumers go as far as to refuse to purchase products that involved any genetic modification in their processing – such as animal products from sources that used genetically modified feed.

Many governments are still implementing GM-friendly policies; 25 countries have policies allowing the cultivation of GM crops. Unfortunately, many developing nations that desperately need to increase their harvest yields have yet to employ GM crops, which are often beyond their means due to the regulatory systems that need to be put into place (ISAAA, 2007). As seen in Figure 19, the initial boom of GM crops began with industrialized nations. Developing nations have been gradually increasing their area of GM crops – mainly in South America, with Argentina taking the lead at 19.1 million hectares by 2007. Also by 2007, South Africa was the only country in Africa to grow GM crops, and since then only Egypt and Burkina Faso have been added to the list of African GM crop nations (Hennigan, 2010). Other developing nations have taken a stand against GM crops in the face of famine, refusing to grow and import GM foods. Despite a third of the nation facing starvation, Zambia banned GM foods in 2003, fearing long term

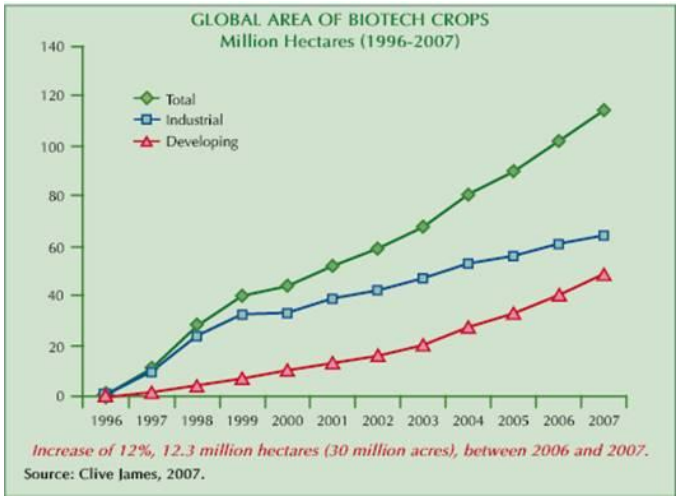


Figure 19: Area of GM crops cultivated in millions of hectares (ISAAA, 2007)

health effects. The government stated that it was following the cautionary principle in which "a country should not take action that might adversely affect human and animal health or harm the environment" (Manda, 2003) when dealing with scientific uncertainty. This sparked the debate over GM food aid and whether it should be accepted, since nations that produce GM crops are a large source of emergency aid. It is noted that short-term emergency relief is not the whole picture, and the problem is not "whether a few sacks of GM maize are going to make people in Southern Africa keel over and die, but whether the international community is really bent on helping African farmers support their families, their communities and their integrity," as stated by Genetic Resources Action International (GRAIN), an international organization against GM crops for environmental reasons (Manda, 2003).

Imports and aid are not the only concern brought about by differing global policies. In 2004, the US-based biotech company Monsanto filed a lawsuit against Canadian farmer Percy Schmeiser when their patented genes for Canola resistant to Roundup (a weed-killer) were found in Schmeiser's Canola plants. The issue, however, was not that Schmeiser had stolen Monsanto's gene – rather, he had planted the seeds of his 1998 crop, which had been cross-pollinated with Monsanto's nearby crop. The court ruled in Monsanto's favor, citing patent infringement, giving them ownership over the crops that Schmeiser had worked on for 50 years. Since Schmeiser had never used the weed-killer to which the patented plant was resistant, he did not have to pay the $200,000 fine. However, the incident raised questions about the patenting of genes and the potential abuse of cross-pollination (Verhaag, 2008), especially considering that this sort of cross-contamination is virtually unavoidable. Although this case involved two crops in

one country, it raises the question of cross-contamination over country borders, especially in the small, closely neighboring countries of Africa. If more African nations begin implementing pro-GM policies while others continue implementing anti-GM policies, how would bordering croplands be handled? This would likely lead to the necessity of international policies, such as a declaration of how far from a country's borders GM crops must be. Regardless, cross-contamination across borders is highly probable.

Not all GM crops are modified to increase yield for human consumption. A modified potato strain called Amflora, which is modified to produce a higher amount of starch for industrial purposes, was recently given the okay in several European countries for industrial use and animal feed. Even though strains such as this are not directly consumed, there is still strong disapproval due to the feared health consequences of consuming meat from animals that were fed with GM feed. Resistance to even the smallest of genetic alterations prevents the industry from developing and implementing technologies that have a great potential to aid in agricultural sustainability.

Fishing and Aquaculture

Land is not the only available location for food production. Fishing has been a common practice for the past 40,000 years, although it used to be that only wild aquatic species were available to be fished. Modern fishing includes aquaculture, or fish (among other aquatic species) bred in fisheries solely for the purpose of harvesting, as well as traditional bait-and-catch.

The spread of aquaculture has increased dramatically over the past two decades, and at its present rate appears to have the capability of surpassing the production of

traditional capture, as seen in Figure 20. World capture production, however, has seen only a minor increase since 1992, and has actually had an overall decline since 1994. According to the FAO, 70% of major fish populations are currently over-fished (Finfacts, 2010). The decline in capture production can be attributed to this, as well as the increased importance of aquaculture.

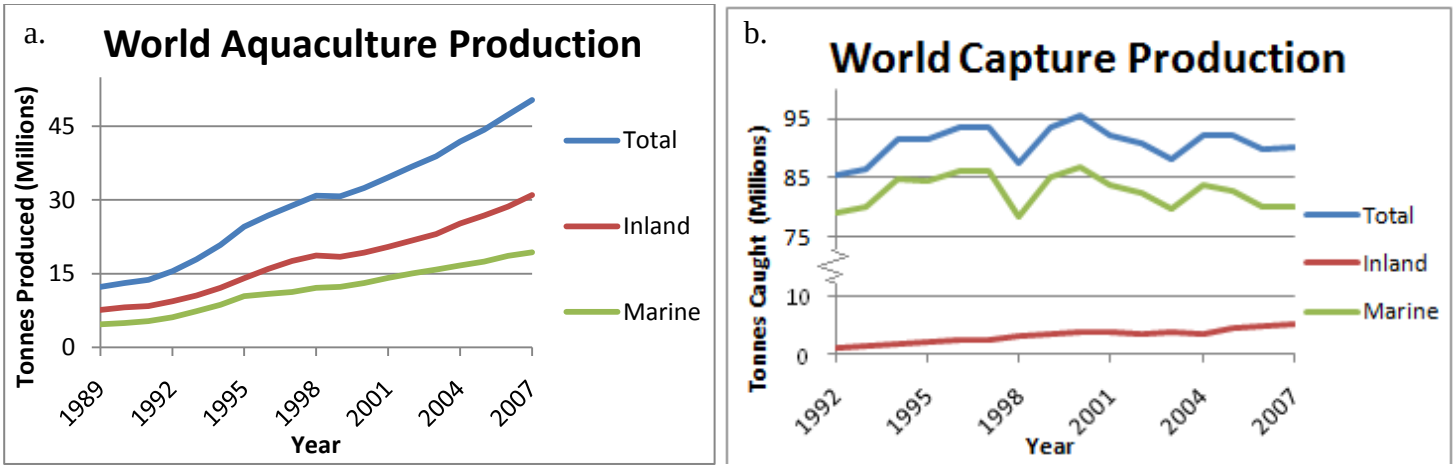


Figure 20: a. World aquaculture production of fish, mollusks, crustaceans, etc. in million tonnes. b. World capture production of fish, mollusks, crustaceans, etc. in million tonnes. (FAO, 2010).

Open Sea Fishing

The general attitude towards open sea fishing in the past has been that once a species has been fished to depletion, one can just move onto the next one. However, as species are declining, so are the populations of other fish. Life is thought to be more dependent on biodiversity in the ocean than it is on land, so the over-fishing of one species has drastic effects on other fish stocks and marine populations. Community structure is regulated by both top-down and bottom-up factors, meaning that the decline of medium-sized fish species lessens the number of larger species while increasing the number of smaller species through a complex chain. This can lead to potentially harmful algae blooms (Black, 2006), which further affect fish populations. Unless action is taken, the loss of

biodiversity will continue to induce declines in fish populations and will cause open-sea fisheries to become unproductive in the near future.

Bottom trawling is an open sea fishing technique that involves dragging a large net across the ocean floor and catching marine species almost indiscriminately. This method is widely considered to cause some of the most ecological harm due not only to the fishing aspect but also the indirect effects the net has on the ocean community. When the net is dragged across the ocean floor, it stirs up sediment, which has many drastic effects (Figure 21). One of the most harmful consequences is the formation of algae blooms, which result when sediment, containing algae cysts and nutrients, mixes into the water column and creates a prime environment for an explosion of algae growth. This explosion of growth causes dissolved oxygen to be consumed at a very fast rate, killing fish. Some algae species create blooms called Harmful Algae Blooms (HABs), which release detrimental toxins that can have effects on both wild fish and aquaculture fisheries, depending on the spread of the bloom. The toxins can also cause mild respiratory problems in humans – however, algae blooms are more harmful to humans indirectly, when shellfish that have filter-fed on the algae are consumed. Algae blooms occur naturally in waters that are prone to sediment upwelling during storms, but trawling can also affect areas that are not commonly disturbed by natural forces (Weaver, 2008). Since trawling sediments drift, there are international repercussions. Many nations have

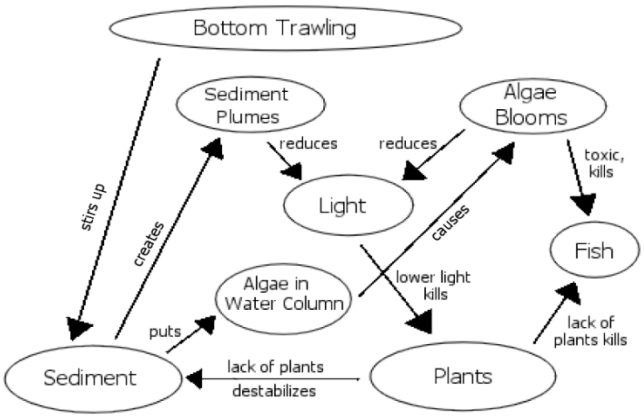


Figure 21: Indirect effects of bottom trawling on marine ecosystems

banned or severely restricted bottom trawling – south pacific nations have put an end to bottom trawling in an area sizing 14% of the Earth's surface, the USA has placed several bans and restrictions around its coasts, and the General Fisheries Commission for the Mediterranean has banned trawling below 1,000 meters (Norse, 2008). However, the UN has yet to place an outright moratorium on bottom trawling, resolving only to take precautionary measures. Iceland has been ridiculed by environmentalists for its resistance to banning, and also for the fact that the nation has taken up commercial whaling (BBC, 2006). Bottom trawling will continue to have global effects unless other nations join in the banning and restrictions, especially since some areas are more prone to algae blooms than others. For the international community, "the real question becomes which cysts of which species are the most important in any particular area.This means that there are specific time windows, combined with specific locations, with specific HAB species, where bottom trawling should not occur" (Weaver, 2008). It is also important to note that fertilizer runoff is a factor affecting algae blooms as well, since the extra phosphorous and nitrogen that is deposited into ocean sediment creates an overflow of nutrients when the sediments are disturbed, allowing the algae populations to explode at a faster rate.

Aquaculture

Although aquaculture may appear to be detached from open sea fishing, it in fact greatly depends on it. Fish bred in man-made fisheries are fed fish meal, which comes from fish caught in the open sea. This is detrimental to populations of small fish which, unlike their larger

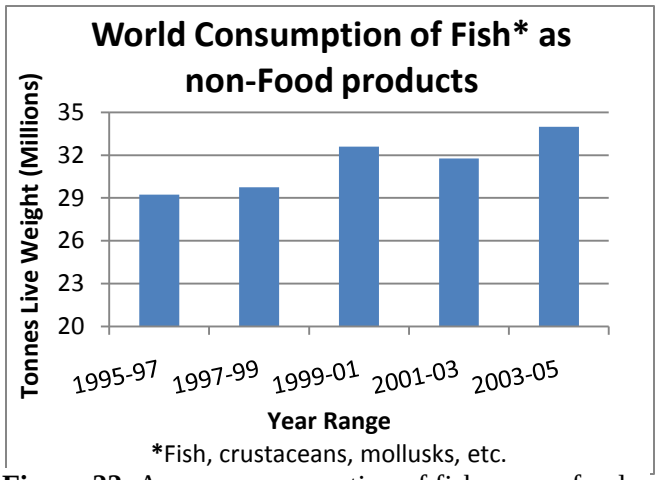


Figure 22: Average consumption of fish as non-food products (FAO, 2010)

counterparts, are not sold commercially. This stock reduction in its turn affects the marine life that relies on it as a fundamental source of food. Use of these small fish, called trash fish, increases the reliance on wild fish, opposing the idea that aquaculture systems reduce it. As shown in Figure 22, one decade saw a dramatic increase in the tonnes of marine life consumed as non-food products, including uses as animal or fish feed. In 2006, the aquaculture sector consumed approximately 23.8 million tonnes of fish meal, fish oil, and pelagic (open-ocean) fish, making up over half of the consumption value (Tacon & Metian, 2009). Approximately 37% of world captures today are ground into feed, which is a radical increase from the 7.7% of 1948 (Stier, 2007).According to the International Fish Meal and Fish Oil Organization, the global supply of fish meal dropped by 25% over the years 1994 to 2005, and the supply of fish oil is worse off. A factor in the depletion of the fishmeal supply is the amount that must be fed to farmed stocks compared to the amount produced from farmed stocks; "to create 1 kg (2.2 lbs.) of high-protein fishmeal, which is fed to farmed fish (along with fish oil, which also comes from other fish), it takes 4.5 kg (10 lbs.) of smaller pelagic, or open-ocean, fish," and ranched tuna requires an input of 20kg of pelagic fish to produce 1kg of tuna (Stier, 2007). This means that the production of larger, carnivorous fish species requires a higher input of protein than the production of smaller, omnivorous or herbivorous species. If human tastes were to shift towards these non-carnivorous species, fish production would require far less protein input for the same level of production. For example, the farming of catfish, carp, and milkfish in Asia and some parts of Africa requires less fish input than is harvested because the fish are omnivorous and herbivorous. Global efforts have been made to find alternatives to fishmeal, and the amount of fishmeal required to produce one

unit of salmon dropped by 25% between 1997 and 2001, but the growth of the industry has been too rapid for the reduction to aid in the diminishing supply (Stier, 2007).

On top of inefficient production, aquaculture poses other threats. Farmed fish are generally kept in densely populated areas, making them highly disease prone. Because of this, fish farmers use antibiotics to keep disease down. Although antibiotics are intended to treat disease, there is a concern about the line between disease treatment and preventative use of antibiotics to promote production. As is the problem in humans, extensive or improper antibiotic use results in resistant bacterial strains, which could threaten the global supply of fish in man-made fisheries should resistant diseases spread. This could occur either by the importation of diseased fish or by the escape of diseased fish which then introduce the disease into marine ecosystems (also a problem) and potentially spread the strain to other fisheries. The escape of fish, diseased or not, is an additional concern, since escaped exotic species could threaten native wildlife. Native wildlife is threatened also by the destruction of costal ecosystems due to the waste disposal of the aquaculture sector. Norway is combating these threats by developing fisheries that more accurately imitate natural marine ecosystems – this means combining multiple species to develop a cleaner, more stable system.

Water Supply

Water may cover 70% of the world's surface, but freshwater makes up only 3% of that – and about 68% of Earth's freshwater supply is locked up in icebergs (USGS, 2010). That does not leave a large percentage for human use, and it is shared with the rest of the land animals of the world.

Irrigation

Of the water available to humans, agriculture uses the most. Approximately 70% of water withdrawal (which is the removal of water that will eventually be returned to its source) and 90% of water consumption is attributed to agriculture. Given that a massive amount of this water is put towards irrigation (95% of all water use in China is said to go towards irrigation) and the continuing agricultural development of many countries includes increased levels of irrigation, the future of agriculture poses an increasing threat to the environment (FAO, 2010), as well as other sectors that are increasingly competing for the global freshwater supply.

Groundwater is gradually becoming more saline in many areas, which threatens the already water-stressed future of food production. Increased levels of salts in water are not conducive to terrestrial plant growth, as it actually causes an outflow of water from plant cells due to osmosis (induced by the higher salt concentrations outside of the root cells). Saline water is virtually poisonous to agriculture. For the islands of Micronesia, this is a real fear, as well as for many regions with long coastlines. In some areas, the rising salt concentrations in groundwater are a result of escalating sea levels, which soak into soils and contaminate the previously freshwater reserves. This is a result of groundwater reserves being used faster than they can be replaced by freshwater, allowing saline water to take up the empty spaces and mix with the remaining reserves (Bilsky, 2010). Therefore, reducing water waste would be an effective solution, keeping ground reserves full such that saline water cannot invade. Since irrigation is the largest consumer of groundwater, utilizing more efficient methods would save a vast amount of the

groundwater supply. Flood irrigation is a common practice, but as its name implies, it involves essentially flooding the crops. This leads to a lot of evaporation, which takes away from the groundwater reserves. Drip irrigation, however, involves the release of water near the roots of plants in very small amounts at a time, reducing both evaporation and runoff. Replacing flooding methods with more conservative approaches could save much of the groundwater supply from salinity, which further increases agricultural production since the saline water will not be able to invade croplands and render them infertile. Interestingly, methods that are able to utilize saline groundwater in irrigation systems are being researched and developed. One particular method of supplementary irrigation – in which rainfall is the main source of water – is being developed in Australian grape vineyards, where groundwater salinity has increased by 1.0 dS/m (deciSiemens, a unit of electric conductance, per meter) over the past three decades (Pitt & Stevens, 2010) – most vine plants, including grapes, will experience yield reduction above 1.0-1.2 dS/m (Evans, 2006). In this case, mild salt damage to grape vines can increase salt concentration in grape juice, which leads to salty wines – something certainly not conducive to selling wine. This method of irrigation involves diverting rain towards saline soils beneath the vines and research has shown that it is capable of reducing soil salinity (Pitt & Stevens, 2010).

Other means of water-saving include making other industrial mechanisms more efficient. In countries with leaky piping systems, it is better to fix the pipes before forcing more water into the system, as the time it takes for the leaked water to return to groundwater reserves exceeds the time it takes to draw from them (Bilsky, 2010). Personal practices in the home are also an important aspect of water saving, including the

use of efficient washing and dishwashing machines. Decreasing water waste is not the only solution, though; adding water to the supply is another method. Desalination facilities are used in several countries, with the United Arab Emirates being almost completely dependent on desalinated water (Bilsky, 2010). However, desalination plants require a lot of energy, and the current use of unclean energy accelerates climate change – the source of rising sea levels – and just makes the problem worse.

Since climate change is affecting the agriculture and drinking water supply of regions such as Micronesia, there has been an outcry asking western nations to rethink their climate policies. This threat to groundwater reserves is potentially the largest problem that many regions face and cannot combat on their own; it will take a global effort to save these regions.

Optimism in a Global Society

Despite the agricultural problems faced due to environmental, ethical, and population concerns, there are also several positive aspects of an increasingly interconnected world. The development of a global society has shifted many national resource concerns into the realm of economics and global policy. The idea of food security is that the populous of every nation should, over a long period of time, be sufficiently nourished; the ideal is 2400 kcal per person per day (Young, 1998) – the US national average at the beginning of the decade was 3790 kcal per day, and in Zimbabwe it was 2020 (FAO). However, not all countries can produce a sufficient amount of food due to limited land resources, limited water availability, and other factors. Should a country such as this stand alone, it would have significant problems feeding its people.

However, the import and export of food, which has been vital throughout history, makes up for the deficit. As determined by Young (1998), "by 2010, developing countries will have a cereal demand of 1392 [Megatonnes (Mt)], production of 1231 Mt, leading to a net import requirement of 161 Mt; this can be met by the surplus from developed countries" (p.227). Not only is the deficit met by imports, but also emergency food aid, in some cases. With countries becoming more connected and more aware of one another, national crises are able to be solved through a global effort, whether through donated aid or simply by giving resource-limited countries the ability to access a wider range of supplies through importation.

A Global Obligation

The main necessity for sustainable agriculture within individual nations is not only for the sake of the individual nations, but rather for the sake of the global society. The production in each nation affects every other nation, whether economically or in terms of food or other product requirements. When one nation maintains poor agricultural yields, whether through unsustainable methods, poor land management, or indirectly reducing land resources through environmental and ecological damage, it takes away from the global society as a whole. In order to maintain sustainable growth, in terms of economics and population, an effort to uphold global policies in regards to requirements for land use, food production and land degradation is necessary.

The independent growth of food production sectors has been shown to be independently unsustainable. When all production sectors and all nations are competing for resources, therefore, sustainable growth of the world is not possible. As said in the

State of the World 2006 report, "the world's ecological capacity is simply insufficient to satisfy the ambitions of China, India, Japan, Europe and the United States as well as the aspirations of the rest of the world in a sustainable way" (BBC, 2006).

Agricultural communities of the world are competing for water and land resources, and corporations in many western nations resort to land-grabbing, or the taking of land in foreign nations for agricultural purposes, when they run out of land. This infringes upon the resources of the native population, whose livelihoods are then affected by the decrease in land resources for farmers, especially when the leased lands have the most potential for irrigation or are close to markets. On top of this, land ownership is not highly documented for locals in many developing nations, and land that is already in use or has been claimed is often involved in leases (Cotula, Vermeulen, Leonard, & Keeley, 2009). Perhaps the introduction of western farming methods into developing nations where land-grabbing occurs (namely in Africa) is beneficial due to improved land management, but it may instead be more ethically responsible to leave these nations with their land resources and instead aid in the development of sustainable practices. It is perhaps an international responsibility to uphold policies that benefit the local population to the greatest extent possible when it comes to land deals.

In the cultivation of genetically modified organisms (GMOs), extensive fishing of seas, and the expansion of land, it is the duty of each nation to develop policies that maximize the protection of biodiversity and the ecosystem, which consist of fragile interconnections across the Earth. The faults of one nation in regards to biodiversity have effects that overlap with other nations, meaning the entirety of global society needs to take precautions when it comes to protecting the world's flora and fauna.

The rising of sea levels in relation to climate change is a major consequence of poor global policies. Nations (especially those that are highly developed) need to take into account the fact that, while their emissions may not have a drastic effect on their own lands, it does have a collective effect on the rest of the world and has detrimental effects on regions like Micronesia, which are facing the consequences of other nations' actions. Eventually, the effect will be drastic globally, and high salinity in groundwater will be a problem throughout even the largest of nations unless global actions are taken.

Most importantly, every nation must realize the effects of population growth and take steps to stabilize their growth rates. With a projected increase of over 2.5 billion by 2050, it is evident that global resources will not be enough to combat drops in food security. It is a controversial topic, but unless countries can follow China's lead of establishing a child planning policy, excessive growth could exhaust the world's resources before the agricultural industry has a chance to catch up technologically.

Ultimately, it is the responsibility of every nation to ensure the sustainable growth and development of the entire world.

ANALYSIS

The five aspects of globalization on which we have focused are intertwined in various ways. Some connections are more pronounced than others, but overall each area is dependent on every other area. Education and communication are connected through the people who rely on them. These people are connected globally through international economic systems and trade unions, on which the trade of agricultural and energy products rely. Education and communication are also connected with agriculture and energy with the formation of agricultural and energy policies.

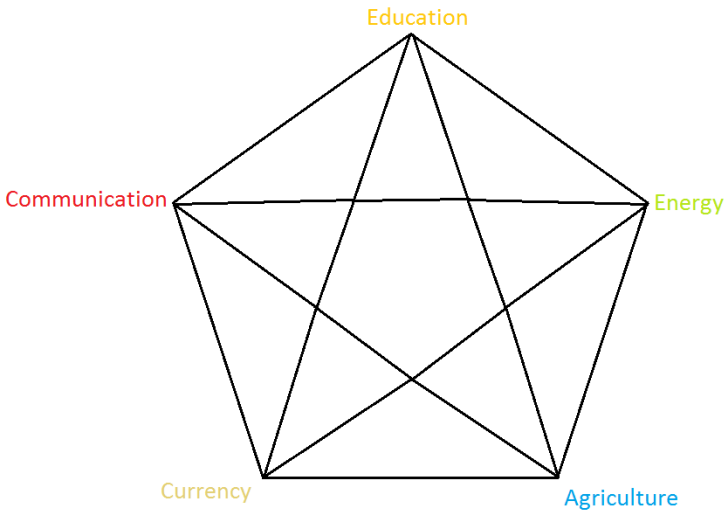


Figure 21: Illustration of the network of aspects of globalization.

The main problem faced in sustainable agriculture is poor land management, such as the improper use of shifting cultivation, which degrades land, or a lack of irrigation, meaning a lower yield potential. Poor methods such as these are most commonly utilized in developing countries, where the quality of education is sub-par. Therefore, it can be seen that the educational infrastructure of a nation has a great influence on its agricultural success. Through the use of integrated curricula in developed countries, more innovative

and successful agricultural methods have been developed as a result of having a wider knowledge base. Brain drain is also a source of the poor agricultural performance of many developing nations, as the most qualified individuals are leaving their native countries in search of better working conditions and opportunities. What remains are people who are only capable of feeding their nation on a day to day basis and lack the educational foundation with which to develop strategies that will provide for the long-term.

Global policies pertaining to sustainable agricultural practices cannot be developed without communication between nations. Due to the fact that there are 6909 living languages in the world, spreading the word about global policies is virtually impossible without the use of a lingua franca. However, since policies relating to land management are most needed in developing nations, where foreign languages such as English may not be frequently taught, there is a difficulty in implementing policies where they will have the greatest effect. Therefore, the complete integration of global policies requires the use of a worldwide lingua franca. Nevertheless, the use of a lingua franca is not the only step necessary towards the spread of global policy. Developments in communication technology will help to increase the ability to relay messages to more remote areas in sufficient time. Such communication is necessary to enable the full implementation of agricultural policies.

Communication is also necessary in the realization of global policies regarding energy. With the rapid depletion of fossil fuels, the importance of sustainable energy is more evident than ever before. In establishing worldwide energy systems, international cooperation is essential, and such cooperation would not be feasible without the use of a

common language. The predominance of the Internet has allowed for the sharing of ideas in regards to sustainable energies; it fosters development which originates from the people. Such communication techniques will also allow for the spread of ideas and policies regarding energy in the future. However, the use of new technologies for communication increases the demand for energy. This amplified demand highlights the need for clean and sustainable energy.

Unfortunately clean and sustainable energy is not always cost efficient due to both high initial and continuing maintenance costs. Sustainable energy systems can thus be virtually unattainable to nations with struggling economies and unstable currencies. On their own, these nations cannot overcome the initial costs required to install such devices as wind turbines or hydroelectric power stations. Were nations to band together in a cooperative attempt to implement renewable energies on a global scale, richer nations could help poorer nations to overcome these costs and make the world more sustainable. However, attention should be paid to which nations band together, because monetary unions such as the Gulf Cooperation Council, should they form a regional currency, could form a monopoly on the oil industry. This monopoly could be both beneficial and detrimental; although the costs of oil would see a steep incline, this could force a great change over to renewable energies.

The economic condition of a nation can determine its attractiveness to highly educated individuals. Poor conditions can result in a “brain drain,” which is the outflow of people whose intelligence could be beneficial to their own nation’s success. For example, if a nation’s currency is devaluing, it would be difficult to maintain the salary levels of individuals who are both highly skilled and thus highly paid. This may drive

them to seek better career opportunities in countries where the economy is more stable. This results in the loss of useful intelligence which could have been harnessed in order to bring their country out of its struggle. On the other hand, many people, who are dissatisfied with the educational system provided in their native country, seek a better education abroad. However, in this case, these scholars do not leave with the intention of never returning, but instead plan to use their newly acquired knowledge to improve conditions in their native community, resulting in a "brain gain."

Intercultural communication is an integral component in the expansion of world networks. In order for this communication to be successful, those involved must possess certain skills, which can only be acquired through effective educational systems. Institutions will need to prepare students for cross-cultural interactions in a global society by equipping them with language skills, which are essential for international relations. In regards to language skills, lingua franca should be emphasized in curricula. With globalization, comes the increased importance of collaboration in the workplace, and such collaboration is only successful if those working together possess interpersonal skills. The development of interpersonal skills begins in the classroom, where students are exposed to team-building activities and engage in intercultural training, which is essential if one is to work in a culturally diverse team. Educational methods are also changing with the development of new types of media used to communicate ideas. The Internet brings new ideas directly to students, and instructors can use various technologies, such as projectors and distance-learning software, to share knowledge. E-books and digital copies of documents that would formerly be printed are helping to increase sustainability and decrease the cost of learning. Overall, communication

technologies are influencing how people are being educated, and the education they are receiving emphasizes more and more the necessity of communication in a global society.

International communication is also vital to the formation of regional currency areas. As the main goal of an RCA is to facilitate trade between the member nations, they must be able to effectively communicate with one another. For both the Central African Economic and Monetary Community (CAEMC) and the West African Economic and Monetary Union (WAEMU), communication was easy because all of the nations involved were French colonies, and thus had a common language. On the other hand, the euro zone has 17 official languages, making communication both difficult and inefficient. This is where the necessity of a lingua franca becomes apparent. It would not be exceedingly difficult to implement one, especially since most students in European nations learn English as a foreign language. The use of a lingua franca would aid in the negotiation of economic policies, due to the fact that some words, which are very specific, do not always have direct translations. Ultimately, the use of a common language can help to facilitate in the development of economic unions across multiple nations.

An RCA could be beneficial to the agricultural communities of developing nations. Western corporations often take advantage of cheap land prices in developing nations and lease this land in a process called land grabbing. These corporations then harvest crops that are not generally intended to benefit the local communities. In an RCA, land grabbing may be less likely to occur, since the nations in the union have more power as a group than they do individually. Also, depending on the spread of the RCA, the equalization of land prices could decrease the attractiveness of land in another country

and western corporations may be more likely to lease land in their own country. Currency also affects developing nations who depend on agricultural exports. For example, suppose a developing nation has its currency pegged to the US dollar and its main export is coffee. If the demand for coffee in the US drops, there is a subsequent decrease in the price of coffee. Since the developing nation does not have control over domestic monetary policy, it can do nothing to combat the economic shock. Although this is not necessarily detrimental to the nation as a whole, the livelihoods of those producing the coffee are adversely affected. With lesser funds and the inability to cover even some basic expenses, it can be expected that cheaper practices will be put into place, causing further detriment. However, some good has come from this in the past. During the Global Coffee Crisis, the lower coffee price incited the formation of programs to aid struggling coffee farmers. The intent of these programs is to help farmers increase the quality of their coffee beans, such that the raise in price due to higher quality will compensate for the overall lower price. Not only does this aid farmers financially, but also in their farming practices, which ultimately benefit the nation as a whole due to reduced land degradation.

Global warming also accelerates land degradation, which is a direct effect of emissions created by the burning of fossil fuels. First of all, global warming raises sea levels, which in turn increases the salinity of groundwater reserves, which decreases soil fertility and therefore adversely affects agriculture. Chemical compounds in the emissions increase the acidity of precipitation, which also changes soil fertility and harms plant life. As we move to cleaner energies more problems are created for the agricultural sector. With the advent of biofuels, there has been an increase in competition for land

between those planting crops for food and those planting crops for biofuel. More and more crops, such as sugar cane and maize, are being allocated as biofuel sources, which ultimately reduces food security. The demand for food staples, such as maize, increases, and as a result the prices increase. This is harmful to developing nations who rely on such staples. Other increasingly popular renewable energy sources, such as hydroelectric power plants, can be harmful to the agricultural sector. Dam construction for these power plants involves the formation of large reservoirs. This has a dual effect on agriculture; the isolation of water increases irrigation possibilities, but often the land covered by the reservoir is fertile land that was previously used for growing crops. Nonetheless, there are clean energy solutions that do not have such dramatic effects on agriculture, and, in fact, some are potentially beneficial. The use of algae to produce biofuels does not take away from agricultural land area, and the biological refuse is often used as fertilizers and animal feed. This refuse can also be used to supplement fishmeal, which would in turn aid in maintaining biodiversity in the oceans due to a smaller need for trash fish to feed fish in man-made fisheries.

Advancements in renewable energy technology are being fueled by the academic community. Evidence of this can be seen in the design of today's learning institutions. Exterior features, such as solar panels, and interior features, such as motion-sensing lights are a common sight at present day academic establishments and show how deeply the desire for a cleaner society is grounded in academia. In addition to implementing ecologically friendly architectural design, schools are also contributing to the welfare of the environment by educating today's youth about factors of environmental degradation and encouraging them to form solutions. Problem based curricula, which place

environmental scenarios at the core of the curriculum, effectively display to students how environmental problems can be resolved by drawing upon various areas of knowledge, such as technology education, social studies, and mathematics. The result of such an integrated curriculum is a well-rounded individual who is capable of employing ideas from an array of academic disciplines in order to find solutions to the numerous environmental dilemmas that plague the earth.

These interconnections illustrate a fragile network that is constantly changing due to variations in each individual hub. The continuation of globalization, or the failure of it, will be shaped by these dependencies, judging by the past developments that have brought globalization to its present state. Overall, globalization has developed in a stepwise and cyclical manner, with the environment and its products being the base for society, society being the base for communication and education, communication and education being the base for a global economy, and the global economy being the regulator of environmental consumption.

CONCLUSION

Each aspect of globalization detailed faces its own individual problems. First of all, in order for nations to function effectively in the increasingly connected global society, educational systems must undergo thorough reformations that will foster the growth of knowledge-intensive economies. With the growing levels of cross-cultural interaction comes the greater mobility of information and the greater need for the ability to communicate internationally. This entails advancements in communication technology, the development of new types of media, and the implementation of a lingua franca. As globalization progresses, the importance of a stable economy is amplified. Due to exchange rate regimes, nations are becoming more dependent on each other's economies, resulting in greater worldwide sensitivity to isolated crises. For example, a nation whose currency is pegged is affected when the economy of the nation with the stronger currency suffers. A global society, in which resources are pooled for the world as a whole, obliges individual nations to be mindful of their energy consumption. Also, in a world where emissions have widespread effects, it is the duty of nations to impose policies concerning the sources of their energies, such that there are cleaner energies and subsequently fewer environmental effects. Lastly, for agriculture to be sustainable in the world, it must be sustainable within individual nations; otherwise, the failure of one nation to implement policies concerning land management and agricultural practices will result in the over-dependency on the resources of other nations, thus affecting the food security of other populations. Therefore, it is necessary to develop global policies such that there is food security for the world population.

Due to the interdependencies of these facets of society, the ability to sustain a global society requires that they are all maintained. The collapse of one is enough to undermine global function and throw global society into a state of chaos. If educational systems around the world were to fail to develop further, energy-related innovations, which are fueled by the academic community, would become few and far between. With fewer advancements in sustainable energies, populations would be forced to rely on dwindling preexisting energy sources, resulting in the elevation of energy prices and the inability to power common modes of global communication. A loss of easy global communication would complicate the global economy, leading to a collapse of exchange rate regimes and modern trade. Developing nations that rely on agricultural imports and exports would lose the foreign assistance vital to their food security, and depopulation would follow. This is obviously a worst-case scenario, and due to the resilient nature of humans, they would likely adapt to changes in the world situation. Nonetheless, there would still be harsh repercussions following the failure of even one facet of society.

The idea that globalization has some benefits and some detriments for each facet makes it difficult to determine whether or not globalization is sustainable. The fragile nature of the interdependencies that bind the facets puts the longevity of globalization at risk. Thus, globalization is a phenomenon that must be carefully monitored to ensure the stability of the international society while also developing a better standard of living for the global population. Regardless of the nature of globalization, it is ultimately inevitable, and although measures can be taken to mediate the world's growth, mankind will eventually have to adapt to a world that can change but no longer grow.

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