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Editor
Prof. Dr. Mokbul Ahmed Khan
Vice Chancellor
European University of Bangladesh
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Opinion expressed in the articles are those of the authors' and do not represent the point of view of the Editor or European University of Bangladesh

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European University of Bangladesh
Permanent Campus: 2/4, Gabtoli, Mirpur, Dhaka-1216
Cell: 01713-006814, 01914-098494
Email: makhaneub@gmail.com

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Editorial Note

European University of Bangladesh is now in its permanent campus at the busiest gateway of Dhaka City --- Gabtali, Mirpur. We are at the fag end the construction of kits 5.5 lac sft massive academic building. The University has by now 17,000 plus students, 450 Teachers – and around 350 support staff. We received more than 50 resear4ch based articles for publication. So, it was a herculean task to choose four articles out of fifty.

This Third Issue contains 4 (four) articles covering multi-disciplinary issues. The first article deals with the revolutionary concept of Social Business, various conceptual interpretations, its application to different sectors of the economy, and various other issues. The author of this article, Dr. Farzana Alam, Chairman, Department of Business Administration, has been working with epoch-making concept of Social Business by Nobel Laureate Professor Dr. Muhammad Yunus.

Four young teachers, Mr. Ajoy Kumar, Md. Arafat Sharif, Md. Boshir Ahmed and Sunanda Paul, wrote an article on Chitosans, one type of sugar and its application in Agriculture, Textile and Pharmaceutical industries. This is very interesting subject. Another article on Salient Features, Achievements and Policy Options of Present Microfinance Program in Bangladesh, has been authored by Munawar Reza Khan, an NGO-practitioner. This article gives a pragmatic picture of implementation of Microfinance Program in Bangladesh. The fourth article is authored by Mr. Obaidur Rahman, Chairman, Department of Computer Science and Engineering, European University of Bangladesh, deals with "Information Security : A Modern Cryptosystem of Public and Secret Key". This is a very critical area, needing special attention of the concerned academics and practitioners. I hope all these articles will be great interest to the readers of our journal.

European University of Bangladesh is a third generation university with clear vision to deal with a social problem --- higher education for poor students. With this end in view, we have kept our tuition fees very low, which is affordable for the economically backward section of our society. We are publishing two articles in this issue dealing with the social problem such as, Social Business and Microcredit, in keeping with our principal focus of preaching education at low cost.

Prof. Dr. Mokbul Ahmed Khan
Editor

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Social Business : Concepts and Realities

Dr. Farzana Alam*

Chapter-I

Conceptual Framework of Social Business

Abstract: *Social Business is an innovative concept that revolutionized the traditional profit-maximization usiness (PMB) philosophy of Capitalist economics. The author has made a modest attempt in this paper to highlight the background and Conceptual framework of social business, various interpretations of Social business, implementation and application of social business concept in various sectors of the economy, institutional framework required for social business, concluding remarks and recommendation for future.*

1.1 Introduction

The Revolution that started in this present era by Prof. Mohammad Yunus through his epoch-making Concept of Social Business can best be compared with the term "Revolution" as used by V.I. Lenin in Soviet Russia or Mao Tse Tung in China. An attempt has been made here to explain both the theoretical perspective and practical application of the Concept of Social Business in various sectors of the economy. In this brief presentation the author has borrowed profusely from Prof. Yunus's books, articles and his unpublished great presentations made in different summits and gatherings. The author, therefore, expresses her great indebtedness to Prof. Muhammad. Yunus as well as to the various sister-concerns of Grameen Group working directly with the concept and practice of Social Business.

1.2 Background of Social Business

The major problem of the present century is poverty; which has arisen more from the income inequality than from the scarcity of resources. Available statistics confirm that 94% of the world income goes to 40% of the people, while the other 60% must live on only 6% of world income. Half of the world lives on two dollars a day or less, while almost a billion of the world lives on less than one dollar a day. [1]. This stricking imbalance is the root cause of poverty and all other poverty-related problems of the present century. Another worst factor to notice is that poverty is not evenly distributed around the world. The income inequality between the rich people in the North and millions of poor people in the Southern part of the Globe has widened. While some of the countries, namely, Soviet Russia, China etc., had achieved characteristic success during the middle of 20th Century, the fall of Soviet Union and various reforms of Chinese Communism have tarnished the euphoria. So, neither capitalism nor socialism in its purest form could be proved to remove the age-old problem of income inequality and poverty. Analysing the inefficacy of both the systems, Prof. Yunus concluded that unfettered markets in their current form are not meant to solve social problems and instead may actually exacerbate poverty, disease, pollution, corruption, crime, and inequality. He examined the beneficial role of Government, NGOs and Multilateral

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* **Associate Professor and Chairman, Department of Business Administration and Director, Evaluation and Faculty Development, European University of Bangladesh, Dhaka**

Institutions (like World Bank, Asian Development Bank etc.) and Corporate Social Responsibility. But Prof. Yunus found all these efforts are partially effective and in his language **"Capitalism is half-developed Structure"** in the sense that Capitalism takes a narrow view of human nature, assuming that people are one-dimensional beings concerned only with the pursuit of maximum profit. The concept of the free market, as generally understood, is based on this one-dimensional human being. Yet the reality is very different from the theory. People are not one-dimensional entities; they are excitingly multi-dimensional. And this is where the new concept of social business comes in.

1.3 The Concept of Social Business

In order to make the capitalistic system more effective, a new kind of business has been put forward by Prof. Yunus, known as Social Business. Entrepreneurs will set up social business not to achieve limited personal gain but to pursue specific social goals.

In its organizational structure, this new business is basically the same as the existing profit-maximizing business (PMB), however, it differs in its objectives. Like other business, it employs workers, creates goods or services, and provides these to customers for a price consistent with its objective. But it's underlying objective --- and the criterion by which it should be evaluated --- is to create social benefits for those whose lives it touches. The company itself may earn a profit, but the investors who support it do not take any profits out of the company except recouping an amount equivalent to their original investment over a period of time. A social business is a company that is **cause-driven rather than profit-driven, with the potential to act as a change agent for the world.**

A social business is not a **charity**. It is a business in every sense. It has to recover its full costs while achieving its social objective.

A social business organization is different from Corporate Social Responsibility (CSR) or Non-Government Organization (NGOs), in the sense that unlike CSR and NGOs, Social Business aims at full cost recovery and concentrates on creating products or services that provide a social benefit. Thus, any private organization runs on profit maximizing business (PMB) principle; while the Corporate Social Responsibility (CSR) and NGOs run on charity with not cost recovery; but Social Business runs on the basis of not only cost recovery but also makes reasonable profit for the organization. Thus, a social business is designed and operated as a business enterprise, with products, services, customers, markets, expenses, and revenues --- but with the profit-maximization principle replaced by the social-benefit principle. Rather than seeking to amass the highest possible level of financial profit to be enjoyed by the investors, the social business seeks to achieve a social objective.

A social business differs from a charity or an NGO or a nonprofit group in another important way. Unlike those organizations, but like a traditional PMB, a social business has owners who are entitled to recoup their investments. It may be owned by one or more individuals,

either as a sole proprietorship or a partnership, or by one or more investors, who pool their money to fund the social business and hire professional managers to run it. It may be also owned by government or a charity, or any combination of different kinds of owners.

Like any business a social business cannot incur losses indefinitely. But any profit it earns does not go to those who invest in it. Thus, a social business might be *defined as a non-loss, non-dividend business. Rather than being passed on to investors, the surplus generated by the social business is reinvested in the business.* Ultimately, it is passed on to the target group of beneficiaries in such forms as lower prices, better service, and greater accessibility.

Profitability is important to social business. Wherever possible, without compromising the social objective, social businesses should make profit for two reasons: **First, to pay back its investors; and second, to support the pursuit of long-term social goals.**

Chapter-II

Various Interpretations of Social Business

2.1 Profits and Social Business

Social Business is a new concept, which has challenged the very basic foundations of Capitalist economics. So, confusions and contradictions about its various aspects are natural. The first question relates to the concept of profit maximization. From the days of Adam Smith, profit maximization was working as the guiding force for business. Although this concept works well for its entrepreneurs, but the contradiction arises when profit maximization exceeded all limits say 80% to 100%. The Capitalist economics did not set any limit; but unlimited profit usually leads to exploitation of the consumers and gross inequality in the economy.

To fill-up this gap Prof. Yunus came forward with his idea and said "But I want to explicitly define social business as excluding the pursuit of profit or the payment of dividends to owners." **[2].** He defended his argument on three grounds.

Firstly, it is immoral to make unlimited profit.

The second argument for defining social business as strictly avoiding the pursuit of profit is a **pragmatic one.** In times of stress, profit will always trump the other bottom lines." When you mix profit and social benefit, and say that your company will pursue both goals, you are making life complicated for the CEO. His thinking process gets clouded. He does not see clearly. In a particular situation where profit and social benefit need to be balanced, which way should the scales be tipped? What if it is possible to increase profit greatly by cutting social benefits just a little --- is that all right? How should one judge? What about in times

of economic stress, like recession --- is it all right to eliminate social benefits altogether in hopes of helping the company to survive? Why or why not? The idea of "mixed" company offers no clear guidance on questions like these. In practice, profit tends to win out in struggles of this kind. Most often the CEO will lean---perhaps unconsciously---in favor of profit, and exaggerate the social benefits being created.

Thirdly, it is necessary to create social business as a clearly defined alternative, separate from the worlds of business and charity, in order to change mindsets, reshape economic structures, and encourage new forms of thinking. For many people, the biggest challenge seems to be getting over the hurdle of the non-profit rule itself. "Can't we take a small profit? It seems as though the idea of profit is like a familiar crutch that businesspeople are afraid to throw away.

Prof. Yunus has put forward a very interesting analogy: Suppose you are trying to quit smoking. Would it be helpful or the opposite to allow yourself to take "just one small puff"? The answer is simple---"a little bit" of backsliding destroys the whole attitude. In the holy month of Ramadan, Muslims are not allowed to eat or drink until after sunset. Why not take a small snack, or even a sip of water, during the day? It would destroy the strength of the mental commitment. In the same way, making a complete break from the for-profit attitude creates a huge and important difference for the businessperson who really wants to commit himself or herself to social change.

Social business is about totally delinking from the old framework of business—not accommodating new objectives within the existing framework. Until you make this total delinking from personal financial gain, you'll never discover the power of social business.

For these and other reasons, a new mechanism is needed. Social business can be that mechanism---provided it is kept completely free from the complication of profit-seeking. Being in social business is like being in a no-smoking zone---even a tiny little puff spoils the whole concept.

2.2 Social Business and Government

Sometimes people raise the question whether social business is somehow akin to socialism or communism. Having grown accustomed to many years of two-way rivalry between capitalism on one side and communism on the other, they may assume that anyone who notices flaws in the theory and practice of capitalism must somehow be allied with the socialists.

Social business offers an option to investors. It is not forced on anybody. It operates in an open economy with free choice. All players in the marketplace are welcome to create their own social businesses---businesses, governments, individuals, foundations, or any other social or economic entity.

Social business recognizes that the responsibility for solving a society's problems is shared between the government and the citizens.

In theory, government should represent all the people and therefore should bear the chief responsibility for addressing social problems that create human suffering. In some fortunate countries, this happens to a greater or lesser extent. But in practice, governments often become captive to special interests, self-serving political parties, and corrupt individuals. Hence the need for social business. If governments had already solved the world's most pressing problems, we would not need social business. But throughout the world, in poor countries and rich countries alike, social problems are plaguing humankind---welfare dependency, unemployment, crime, lack of housing and healthcare, environmental degradation, obesity, chronic disease... the list goes on and on.

Instead, why not experiment with making some of these government operations into social businesses, with the explicit mission of serving the needs of the people? This could be a way of combining the creativity and energy of business with the avowed social purpose of government, producing shared benefits that neither sector has produced before.

2.3 Capitalism, Socialism and Social Business

Capitalism has been working as the most successful system through ages. It's profit maximization concept has been working as the self-propelling system for motivating the investors to grow and expand. But Prof. Yunus found the biggest flaw in the existing theory of capitalism in its misinterpretation of human nature. In the present interpretation of capitalism, human beings engaged in business are portrayed as one-dimensional beings whose only mission is to maximize profit. Humans supposedly pursue this economic goal in a single-minded fashion.

This is a badly distorted picture of a human being. As even a moment's reflection suggests, human beings are not money-making robots. The essential fact about humans is that they are multidimensional beings. Their happiness comes from many sources, not just from making money.

The theory of Capitalism concludes that the optimal result for society will occur when each individual's search for selfish benefit is given free rein. This interpretation of human beings denies any role to other aspects of life---political, social, emotional, spiritual, environmental, and so on. Based on this analysis Prof. Yunus concluded that *capitalism with its profit maximization objective suffered from a fatal flaw and made our economics thinking incomplete and inaccurate* **[3].**

Socialism as an entrim step towards communism was once put forward by some states (USSR, China etc) as panacea to solve the crisis created by the selfish-profit motive of capitalism. Total Government intervention in all the affairs of management of business and equal treatment of all brought some tangible good results in solving the serious economic crisis of poverty alleviation in those countries. But the brightness of success was blunted by the loss of individual initiative, entrepreneurship and various other self-propelling forces.

A social business is a new kind of business. It's quite distinct from either a traditional profit-maximizing business (which describes practically all private companies in the world today) or a not-for-profit organization (which relies on charitable or philanthropic donations). It's also quite distinct from some other frequently used terms, such as "social enterprise," "social entrepreneurship," or "socially responsible business," which generally describe varieties of profit-maximizing companies. A social business is outside the profit-seeking world. Its goal is to solve a social problem by using business methods, including the creation and sale of products or services.

There are *two kinds* of social business. One is a non-loss, non-dividend company devoted to solving social problem and owned by investors who reinvest all profits in expanding and improving the business. We call this a Type I social business.

The *second kind* is a profit-making company owned by poor people, either directly or through a trust that is dedicated to a predefined social cause. We call this a Type II social business. Since profits that flaw to poor people are alleviating poverty, such a business is by definition helping to solve a social problem. Grameen Bank, which is owned by the poor people who are its depositors and customers, is an example of this kind of social business.

To understand more clearly what Social Business is, we may look at the following Seven Principles, developed by Hans Reitz, and described below:

1. The business objective is to overcome poverty, or one or more problems (such as education, health, technology access, and environment) that threaten people and society---not to maximize profit.
2. The company will attain financial and economic sustainability.
3. Investors get back only their investment amount. No dividend is given beyond the return of the original investment.
4. When the investment amount is paid back, profit stays with the company for expansion and improvement.
5. The company will environmentally conscious.
6. The workforce gets market wage with better-than-standard working conditions.
7. Do it with joy!!!

The Seven Principles are the core of social business.

Chapter-III

Social Business in Practice

3.1 Application of Social Business

Social Business is attracting investments very fast. It is spreading throughout different sectors of the economy. According to an estimate as early as in 2011 alone, 60 impact investing funds were created, raising the combined total capital available for social investments to an estimated $40 billion. About 2.8 per cent of U.S. worker are already involved in hybrid social enterprises.[4]. Even the European Union estimates that more than 25% of all new enterprises in Europe can be considered social enterprises [5]. The social business companies are being established with primary objective of solving one or more social problems by applying business principles. Such social business companies are now found almost all the sectors of the economy. Here in this chapter an attempt has been made to highlight few examples of such social business companies drawn from different sectors, namely, Healthcare, Water, Energy, RMG and in Service Sectors.

3.2 Social Business in Healthcare

Social Business concept has been successfully implemented by Grameen Health Care Trust since its inception in 2006. Grameen Healthcare Trust (GHT) is a not-for-profit organization created by Nobel Laureate Professor Muhammad Yunus established under Trust Act of Bangladesh in 2006.

GHT was established with the goal of developing the health sector in Bangladesh; especially to fulfil the unmet needs for health care services to low-income groups in rural Bangladesh. GHT not only involves itself in building health institutions but also supports other institutions working in the health sector. It works to coordinate national and international efforts to support and undertake various health programs in Bangladesh.

Grameen Healthcare Trust (GHT) has invested in a social business called Grameen Healthcare Services to establish the Grameen Green Children Eye Care Hospital in Bogra and Barisal. GHT invested in the construction of hospital buildings, procurement of equipment and machineries, training of doctors and medical staffs. GHT also invested in Grameen Caledonian College of Nursing (GCCN).

GHT has created joint venture partnerships with leading German chemical company BASF for social business. Grameen BASF is a social business that uses unique technology to produce impregnated mosquito nets that stay effective even after 20 washes to fight mosquito bore disease such as malaria, filarial and dengue in Bangladesh. Grameen Uniqlo is a joint venture social business in order to produce affordable clothing for the poor as a way of improving their health and standard of living, and specially targeting women's health through the production of affordable hygienic sanitary products.

3.3 Social Business in Energy Sector

Social Business projects were also undertaken in Energy Sector --- a very vital sector of Bangladesh. Grameen Shakti Samajik Byabosa Ltd. (GSSBL) has been undertaking various social business projects in this sector.

Grameen Shakti Samajik Byabosa Ltd. is one of the Social Business Company in Grameen family. GSSBL is a not-for-profit organization registered under the companies Act. 1994. GSSBL has started its operation in 2010. It has registered office at the Grameen Bank complex, Mirpur-02, Dhaka-1216, and Bangladesh. Nobel Laureate Professor Muhammad Yunus is founder chairman of Grameen Shakti Samajik Byabosa Ltd.

GSSBL started is operation last April 2014. In the year of 2014 the organization has invested BDT 3, 32, 60,000 in 168 projects.

The Grameen Shakti provided clean energy to rural households through solar home systems, cooking stoves, small biogas plants etc. at very affordable price. Available statistics reveal that the 8 million rural poor beneficiaries were provided the services and more than 12,000 jobs were created. The clean Energy for Rural Household Project has reached break-even point long ago.

3.4 Social Business in Water Sector

The principal components of this social business projects includes amongst others, delivering drinking water through tap point network and subsidizing the cost with jar sales in Dhaka and in rural areas. Grameen Veolia Water Ltd. was established as a joint venture company between world renowned French Company Veolia Water and Grameen Health Care Services in 2008 to serve people with safe drinking and cooking water in arsenic-prone areas of Bangladesh. The company implemented a water treatment plant with 9 Km networks at Goalmari in Daudkandi, Comilla district. According to DPHE (Department of Public Health & Engineering of Bangladesh), 83% drinking water source (Tube wells) in this area are arsenic contaminated. The villagers now have access to Grameen Veolia Water through public tap points and private connections all around Goalmari and Padua union.

Social Business in Water Sector

- Risk of Arsenic poisoning of 37 million to 77 million people in Bangladesh
- High contamination of tube-wells which is the primary source of water in rural and remote villages.
- Lack of pure-drinking water in Bangladesh which is one of the basic necessities of human life.

OBJECTIVES OF GRAMEEN VEOLIA WATER LIMITED

- To provide arsenic-free pure-drinking water to the people of Bangladesh.

IMPACT OF GRAMEEN VEOLIA

- **Community Level**
  GVW is distributing its safe water through 9 km network pipes in Goalmari through 50 public tap points and 60 private connections (community connection, house connection and also school connection). Each public tap point is being managed by a lady water dealer creating job opportunity of 50 rural ladies. More than 600 families are regularly using the water for drinking and cooking purpose in the area.

- **20 L Jar Water Business**
  - Launched on: October 2011
  - Follows the treatment of ACF, DMF, MF, RO, UV, Ozonation etc
  - Daily distribution : Around 650 jars / day
  - Transportation means to Daudkandi / Dhaka : By Boat from Goalmari Plant

ACHIEVEMENTS IN YEAR 2014

- In 2014, GVW have established 20 new connections and carried out 3 baseline surveys for network expansion to cover more 5000 potential beneficiaries. Also a new trend has been noticed for GVW's water in other villages under municipalities' area also.
- From February 2014, GVW started direct distribution in Dhaka.
- In 2014, a high profiled scientific committee for GVWL was formed for better understanding of ideas, demands and approach by involving the top leaders of the country rendering contribution to the water and sanitation. Representatives from Government, international institutions (World Bank, Unicef), NGOs (Water Aid, NGO Forum), universities (Stamford) are enriching Grameen Veolia Water's reflection on new models for access to pure water in Bangladesh.
- GVW is illuminating the image of social business model by demonstrating its activities regularly during Social Business Day and during Social Business Summit. In November 2014 GVWL took part at Global Social Business Summit in Mexico actively and involved in focus group discussion on water jointly organized with Danone and Veolia.

HIGHLIGHT AND IMPACTS

- In order to address the health and hygiene to the targeted population, GVW carried out a study in the project area with cooperation of ICCDR, B to observe the sanitarian and social impact in community level.

- An anthropological study was also carried out in the project area by the Canadian Anthropologist Ms Therese Blanchet of DRC to make community people aware of arsenic as well as health and hygiene issue.

- ESSEC Business Institute of France being the academic partner of Veolia contributing in promotion of socio economic intervention of the project activities and monitoring.

This project has so far provided services to huge number of customers, the number of which is increasing day by day.

3.5 Social Business in RMG Sector

Grameen Fabrics & Fashions Ltd (GFFL) is a social business company owned by Grameen Telecom Trust.

SOCIAL PROBLEMS ADDRESSED

- Grameen Fabrics and Fashions aims to address lack of adequate employment opportunities.
- It focuses on lack of adequate production capacity for social products.
- It also aims to concentrate on the deficiency of a healthy export balance of Bangladesh encompassing foreign currency reserve enhancement.

OBJECTIVES

- It seeks to generate employment especially focusing on women empowerment and employment equality.
- It endeavors to produce goods to address specific social problems such as bed nets to combat malaria and dengue especially because Bangladesh has mosquito-related endemic frequently wide spreading throughout the nation.
- It intends to induce export led growth in the form of exporting the market-specific goods in the international market to earn foreign currency.

SOCIAL IMPACT

- GFF has already achieved the capacity of producing 2500 nets per machine per day hence reaching a substantial rate of efficient production for exporting. Furthermore, the organization has planned out to increase capacity to produce 7500 nets per day.
- Composite knitwear is in development to produce 60,000 ready-made garments per day and it is to be noted that Bangladesh yet has the comparative advantage in producing ready-made garments for exporting worldwide.
- Grameen Fabrics and Fashions has had protected 75,000 families against insect-borne diseases.
- The organization has generated 450 jobs for rural women already and aims to eradicate unemployment further through increasing the production capacity in this year.
- Furthermore, it is one of the few organizations in Bangladesh to offer social services for employees such as a day care centre and education for employees' children.

3.6 Social Business in Service Sector

Social Business has expanded to various service sectors, like Grameen Shamogree, Grameen Fund, Grameen Shikkha and so on.

Feeding into this growth of new business models is the increasing academic attention that the topic is attracting. Journals on social business and social entrepreneurship are spreading, and many of the leading business schools – such as Harvard, Stanford, HEC Paris, and INSEAD – have established chairs or programs dedicated to the topic.

The regulatory environment and capital markets are also becoming more amenable to the development of social businesses. Governments are beginning to create legal structures designed to support companies with a social mission. For instance, the European Commission's Social Business Initiative aims to provide a favorable environment for social businesses by improving access to funding and reducing regulatory and administrative requirements. Several development agencies, such as the U.S. Agency for International Development (USAID) and African Development Bank (AfDB), have also committed to promoting and developing social businesses.

Chapter-IV

Implementation of Social Business

4.1 Identification of Appropriate Objectives

Identification of appropriate social goal for Social Business Projects is a very important task choosing which need to focus on requires considering three factors simultaneously:

i) clear idea about core capabilities and potential business interest;
ii) understanding of the problems and the root causes; and
iii) understanding of the landscape of stakeholder's legal issues and activities of other players **[6]**.

In order to help the choice of the objectives of social business, some specific issues have been put forward, these objectives must :

(i) Ensure improvement of production and access to market;
(ii) Ensure creation of employment;
(iii) Helps consumers;
(iv) Enables entrepreneurship development;
(v) Provides stability;
(vi) Increases access to infrastructure;
(vii) Adapting technologies used by the wealthy to needs of the poor;
(viii) Enhancing sustainability and environment through technological solutions; **[7]**

4.2 Institutional Framework for Social Business

Institutional Framework is the critical necessity for social business to function properly. But unfortunately in Bangladesh such infrastructural framework is absent due mainly to the fact that social business is a new concept. Here we have discussed the needs for institutional facilities only.

One *important step* in the process of finding funding is creating a business plan that will help you in recruiting an investor network.

When you are ready to launch a full-blown social business that requires significant outside funding, you'll need to create a detailed budget for operationalzing your business. This can be done by creating a five-year financial forecast for your social business, including a robust cost structure that is broken down into various categories, including human resources (generally the largest expense), office space/real estate needs, travel expenses, price of input materials, land and physical resources, and professional services.

Developing a well-structured and detailed financial plan will help you to pinpoint exactly how much funding you will need and when you need it.

Getting access to seed capital is vital to starting the business.

This process of networking will generally begin with people you know---friends, colleagues, classmates, business associates, community members, and people you think may be interested in the social problem you are addressing. In time, your networking will extend beyond personal contacts to include "friends of friends" and other acquaintances. High-tech communication tools such as Web sites, blogs, Twitter feeds, social networking sites, e-mail links, online newsletters and bulletin boards, and other similar connections can also help you find people who may want to support your effort.

One key factor that should be in place before you approach these networks is the **management team**. You should define clear roles for your leadership and designate specific management responsibilities for the various members of your team. **[8].**

Unfortunately, our legal and regulatory systems do not currently accommodate social business. Profit-maximizing companies and traditional non-profit organization (foundations, charities, and NGOs) are recognized institutions covered by specific rules regarding organizational structure, governance and decision-making principles, tax treatment, information disclosure and transparency, and so on. But social business is not yet a recognized business category. This needs to change. As soon as there is a defined legal and regulatory structure for social business ---preferably one with consistent rules in countries around the world---the easier it will be for entrepreneurs and corporations to create a multitude of social businesses to tackle the human problems that are plaguing society.

Social Business Category I : For-Profit Business Structure

The most common option today is to organize the social business under the traditional structure of a for-profit business. This means applying many of the same business principles that are used when developing an ordinary profit-maximizing company, while not losing sight of the social objective that should be at the heart of the enterprise. These for-profit companies claim a social mission, a handful go so far as to renounce the pursuit of profits that benefit the owners---which puts them on the threshold of qualifying as true social businesses. The for-profit legal framework was used for all of Grameen's social business. Such a social business has a traditional ownership structure, which creates clear lines of power and responsibility. The for-profit company has a number of options for raising capital: It can solicit investments from individuals, companies, and investment funds; it can offer ownership shares for sale; and it can borrow money from banks and other lending institutions (providing it can demonstrate its financial stability and creditworthiness). Also, in most jurisdictions, the legal system gives the for-profit company great freedom and flexibility to experiment with its business model.

Social Business Category II: Not-for Profit Structure

Social business can also be structured as a non-profit organization, like the typical charity, foundation, or NGO. In recent years, this model has been expanded by non-profit organizations that create goods and services specifically to benefit the poor.

Obviously there is a lot of work to be done by our governmental, legal, and legislative experts. A new regulatory structure specifically tailored to the needs of social business should be created---the sooner the better. Meanwhile, those interested in launching social businesses will need to use the existing business laws as the basis for creating a true social business.

4.3 Social Business Fund

Finance is a very critical issue for any business. The problem is more acute in the case of social business. This is mainly due to the fact that in profit-maximizing company, profit attracts the investors, but in social business the investors do not get any profit excepting original investment. So, the entrepreneur must pick a social problem which he wants to solve and then seek business solutions.

Profit is important only as a necessary condition, not as the ultimate goal. The entrepreneurs here are not trying to find the most profitable combination between a given market demand and your capabilities. The initial thought comes from somewhere else altogether, from human instinct of compassion. The entrepreneurs here may see or hear about a hardship people suffer and resolve to change it--- a very natural response to the pain of others. Then the entrepreneurs of social business start looking for a solution. If they approach the project in a social business manner, they not only ensure their efforts will last, because they are economically sustainable by covering the costs, but they will also help

the dignity and self-respect of being a vital part of the global economic system rather than mere wards of charity.

Social Business starts with listing of the problems.

The Second Step is use of creativity in finding innovative but socially beneficial solutions.

Today we are lucky because any small creativity can be magnified into big creativity through the power of technology.

Many problems are waiting to be solved: poverty, hunger, disease, healthcare, unemployment, abandoned children, drugs, housing, pollution, environment, and so on.

An Alternative Model:
The Social Business Owned by the Poor

Even profit-maximizing companies can be transformed into social businesses by giving full or majority ownership to the poor. This constitutes the Type II social business. Grameen Bank fall under this category, because it owned by the poor people who are its borrowers. Every year dividends are paid to the bank's owners out of the profits generated through banking activity.

Here are some examples of the kinds of organizations you may want to consider partnering with when launching your own social business:

- *Another social business* ---to replicate, adapt, or expand as existing model
- *An NGO or charity*---to complement and support the existing work of an NGO with your new social business
- *An investor*---a private individual, a company, an investment fund, a philanthropic foundation, or even a governmental body that is looking for a way to create a positive social effect with its investment monies
- *A technology partner*---to sell or license the technological products or expertise needed to make your social business successful, or to join the project as a partner, providing the technology as its contribution
- *A production partner*---to provide you with either raw materials for your own production or final products for you to sell
- *A human resources partner*---for example, an agency that might connect you with talented people who are willing to dedicate part of their careers to a worthwhile cause, or a university that might link you to professors or students with relevant expertise
- *A distribution partner*---which could be an NGO (if you want to sell a product to poor customers), a traditional profit-m maximizing business (if you want to sell a product to wealthy customers), or an Internet marketer (if you want to sell a product to customers who are technologically savvy and widely dispersed geographically)
- *A monitoring partner*---an organization that can help you define and measure the effect of your social business, which could b a non-profit organization, a think tank, or university team with expertise in the area you'll be working on. The better your

monitoring, the easier it will be to convince investors and other partners of the value of your work.

4.4 Global Infrastructure of Social Business

As has been discussed earlier, since social business is a new concept, the legal and financial institutional framework is yet to be developed. Grameen Group has come forward to fill up the gap. Few innovative but effective infrastructural initiatives of Grameen Group are discussed in this sub-chapter.

a) **The Yunus Centre** – The Yunus Centre was established in August 2008 to serve as the anchor of all Grameen-related social businesses worldwide as well as many social business institutions around the world.

The Yunus Centre is a one-stop clearinghouse for all information and resources pertaining to social business ideas and actions. Almost all the social business companies that we've created formulated their initial business concepts within Yunus Centre prior to establishing partnerships with other Grameen organizations. Yunus Centre monitors the progress of social business, facilitates and sustains relationships among social initiatives the world over, and fosters the spirit of the social business movement through events, social media, publications, and websites. It also organizes discussion groups to explore new frontiers of social business, conducts workshops and labs on the concept and practice of social business, and offers volunteer internships to young people from all over the world who want hands-on experience in social business that they can apply in their home countries.

b) **The Grameen Creative Lab**—The Grameen Creative Lab at Weisbaden (GCL) has become the engine for growth of global social business initiatives. It has assembled a very powerful and dedicated team to meet the ever-expanding demand for services needed in setting up world-class social businesses, particularly as joint ventures with leading companies. Based in the German city of Wiesbaden, near Frankfurt, GCL has set itself three main tasks: to communicate about social business; to incubate its own social businesses; and to support the creation of new social businesses by others.

As a social business, GCL pursues the cause of eradicating poverty while itself being economically sustainable. It took almost a year to become operationally sustainable, but by the latter half of 2009 it reached the break-even point. GCL accepts up to three months of volunteer services from interns who want to work there in order to learn about social business. Afterward, they can get paid staff appointments if they can identify clients or develop projects that all GCL to expand and hire them as regular employees. GCL's operating costs are covered by such revenue-generating activities as consulting with large companies, governments, foundations, and other institutions or individuals on setting up social businesses and organizing seminars and other events for which attendance fees are charged.

If a successful social business is like a seed, full of potential for growth, then the people of GCL are like so many Johnny Appleseeds, sowing orchards around the world that will soon be filled with delicious fruit.

c) **University Centers for Exploring and Nurturing Social Business** – Universities can play an important role in developing the future of social business. Universities are widely respected, nonpartisan civic institutions, giving them the ability to make fruitful connections among many kinds of organizations: government agencies, for-profit companies, charities, foundations, and citizens' groups.

Today a number of universities around the world are stepping up to act as catalysts and bridge-builders in the next phase of social business. An interesting example of the various ways academic institutions are promoting this cause can be seen in Scotland's Glasgow Caledonian University.

The new California Institute of Social Business is based at the California State University's Channel Islands campus. It was created through the single-minded efforts of the university's president, Professor Richard R. Rush, who considers it a very important part of this new university.

On the other side of the Pacific, an equally exciting social business program with a very different focus is being developed.

Several projects are already under way at Kyushu University, including:

- One Village, One Portal---an experimental program for using high-tech information systems to collect and organize all kinds of social, economic, educational, agricultural, and cultural information about a particular village in Bangladesh, as a way of facilitating creative thinking and planning for sustainable solutions to social problems.
- E-Health and E-Agriculture projects for managing health records and agricultural information and making the data readily accessible by individuals and the institutes that serve them.
- An E-Passbook system that could be used by Grameen Bank borrowers for managing their savings, borrowing, and other financial services.
- Alternative power source experiments, testing new ways of generating, storing, transmitting, and using sustainable energy sources---solar, wind, biofuel, and so on.

Solutions devised by the students and faculty at Kyushu University will be applied first in Bangladesh, then adapted for use in other developing countries.

Yet another university program centered on social business is the Yunus Center at the Asian Institute of Technology in Bangkok, which is undertaking initiatives to understand and help to solve the problems of poverty through various forms of social business. Launched in August 2009, the Yunus Center at AIT will offer regular short courses on social business, microcredit, healthcare for the poor, environmental and gender equality issues, and other topics of importance for economic development.

d) **Social Investment Funds** --- To support the growth of social business, it will be important to create a number of investment funds committed to supporting social businesses. Such funds will offer a number of services. They will study and evaluate fledgling social businesses, measuring their effectiveness in pursuing social goals and their financial and managerial efficiency, so that investment funds can be channeled to the most promising new ventures. They will serve as clearinghouses for information and ideas about social business, as their managers will quickly become some of the world's leading experts in what works, and what doesn't, in the social business arena. They will help to create a common vocabulary and set of measurement tools for defining success in social business, in much the way that such commonly agreed tools as ROE ("return on equity") and EBITDA ("earnings before interest, taxes, depreciations, and amortization") defined financial success among profit-maximizing companies.

The Danone Communities Fund quickly became very popular, and with the influx of money from enthusiastic Danone shareholders came the opportunity---and the necessity---to identify other social businesses to receive funding.

And the Islamic Development Bank (IDB) in Jeddah, Saudi Arabia, has announced plans to launch the IDB Grameen Social Business Initiative with an initial investment of more than $10 million.

e) **Social Stock Market** ---- In the years to come, social business will continue to grow, gradually forming a parallel world alongside the familiar universe of profit-maximizing businesses. Social business companies will spring up in every country where free enterprise exists, and they will operate in almost every market and business arena, from consumer goods and services to corporate services, supplying, and outsourcing; and from finance and banking to information technology and heavy industry. Investment funds focused on social business will continue to multiply, and so will providers of services and products to help support this expanding universe—for example, investment management firms that specialize in social business, as well as information sources that concentrate on news and anslysis about social business companies.

It seems inevitable that eventually a parallel stock market will spring up that is dedicated to raising investment capital for social businesses and to facilitating the buying and selling of social business shares.

Chapter-V
Concluding Remarks and Recommendations

5.1 Critical Values of Social Business

The charismatic success of the capitalist system during post-war period has created a tragic gap between the Global North and the Global South. The economics of North America, Europe and Japan have achieved endless growth but at the same time the people of the rest of the world were left behind. The Millennium Goals were set to lessening the gap by reducing the poverty rate from 57% in 1991 to 40% in 2005. Although some of the countries of the Global North (including Bangladesh) has made some visible success in achieving Millennium Goals, the inherent income inequality still is present in all these countries. It's a tragic, yet obvious illustrating of how our economic system fails in its mission to serve the needs of humanity. Millions of people around the world are suffering because of few spectaculars' who are blindly grasping all profits.

All of these economic problems are growing worse just as global environmental trends threaten the future of agriculture around the world. Climate change, drought, and deforestation are turning vast areas that were once fertile farmlands into deserts.

Globalization can be a great force for good, one that can bring more benefits to the poor than any alternative. Global trade, for example, has played a major role in the economic growth of the past decade that has lifted millions of people out of poverty n China, India, and Bangladesh.

But it must be the right kind of globalization. The rule of "strongest takes all" must be replaced by rules that ensure that the poorest have a piece of the action, without being elbowed out by the richest. Globalization must not become financial imperialism.

Improved systems of national and international regulation of business are necessary and important. But to provide an alternative to the old-fashioned imperialist for globalization, let's also use the creative potential of social business. In the years to come, powerful multinational social businesses can be created that will multiply the benefits of globalization for poor people and poor countries. Social businesses will bring ownership to the poor and keep profits within poor countries rather than draining them away to further enrich the wealthy. Building strong economies in the poor countries by protecting their national interest from plundering foreign companies will be a major area of interest for the social businesses of tomorrow.

In this backdrop, it may be concluded that Social Business has come as a saviour of capitalism --- as the solution to age-old crisis of selfish motive of profit-maximization.

5.2 Recommendations

As has been stated earlier, Social Business is a new concept and has been passing through experimental stage. We should, therefore, be optimistic to work and observe a better world with social business.

Social business can transform society very quickly because it will apply the amazingly powerful, rapidly-growing power of technology to improving the conditions of the poor and the environment. It will also liberate and harness the power of creativity, the sense of commitment of the new generation of young people of this new century, and the power of selfness which defies all previous notions of human behavior in the economic world.

The world will change in this dynamic time and instead of becoming passive viewers of what would happen in future, we should see ourselves as active creators of a desired world. We should not only welcome the change but also should we play the active role of change-makers. We should dream for a better future. How such future will look like? In the imagination of evergreen Prof. Yunus for such future might look like :

- A world without a single person living in poverty
- A world whose oceans, lakes, streams, and atmosphere are free of pollution
- A world where no child goes to sleep hungry
- A world where wars are a thing of the past
- A world where people can travel freely across borders
- A world where no one is illiterate and everyone has easy access to education through the application of new miracle technology
- A world where the riches of global culture are available to all

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A Review of Chitosans (CS) and its Application in Chemical Industries, Agriculture, Textiles Industries and Pharmaceutical Industries

Ajoy Kumar*
Md. Arafat Sharif**
Md. Boshir Ahmed***
Sunanda Paul****

Keywords: *Chitosan, chemical industries, and pharmaceutical industries.*

Abstract: *Chitosan (CS) is a sugar that is obtained from the hard outer skeleton of shellfish, including crab, lobster, and shrimp. It is also defined as natural biopolymer produced from the exoskeletons of shrimp and crab, which shows antimicrobial activities against microbial pathogens. This study aimed to evaluate the aptitude of chitosan to the fields of chemical, pharmaceutical and textile industries. The CS was used in the preservatives of food without health hamper. So we can say that CS acts as alternative green molecule in view of green chemistry without hampering health and environment.*

1. Introduction

CS is a type of fiber derived from chitin, a substance that develops in the hard outer shells of crustaceans such as crab, crayfish, shrimp and squid [1]. Like other forms of fiber, chitosan is hard to digest and it moves through the gastrointestinal system without being absorbed. CS is available as a dietary supplement purported to help people lose weight and lower cholesterol levels [2]. Consult with a qualified health care provider before taking chitosan supplements. It is a white or light red solid powder, not soluble in water, however soluble in acid medium. It consists of alkaline polysaccharide with lower to high viscosity in aqueous convoy which forms a clear film [2]. It is a contradictory to cellulose, which represent as a homo polymer, it concern with chitosan a hetero-polymer chain connection, which is a high degree of crystalline, long and bendable chains forms. In low PH solution it is positive charge acted as cationic charge. The -OH and -NH2 reactive groups are dependable for the changes of characteristic of new products by different reaction[3]. The agricultural and horticultural uses for chitosan, primarily for plant defense and yield increase, are based on how this glucosamine polymer influences the biochemistry and molecular biology of the plant cell. The cellular targets are the plasma membrane and nuclear chromatin. Subsequent changes occur in cell membranes, chromatin, DNA, calcium, MAP Kinase, oxidative burst, reactive oxygen species, callose pathogenesis-related (PR) genes and phytoalexins [4].CS exhibits antimicrobial activity against a wide range of food-borne microorganisms, thus has gained attention as a potential natural food preservative .Earlier work has focused on the effects of gutting and to date, there has been no study on the use of chitosan for fish preservation. It remains unclear how to prolong the shelf-life of fish fillets [5].

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*Department of Chemistry, European University of Bangladesh, Dhaka-1216, Bangladesh
**Department of Textile Engineering, European University of Bangladesh, Dhaka-1216, Bangladesh
***Department of Biochemistry and Molecular Biology, University of Chittagong, Chittagong-4334, Bangladesh
****Department of Biochemistry and Molecular Biology, University of Chittagong, Chittagong-4334, Bangladesh

They are extensively farmed in Bangladesh and sold in supermarkets and food chain stores, but there have long been issues regarding its storage due to the short shelf-life. Therefore, it is necessary to develop effective methods for extending the shelf-life of these fishes. Food preservation techniques including freezing, chemical preservation, salting and modified atmosphere packaging have been employed to improve the microbial safety and extend the shelf-life of aquatic products. About 80% or more vegetable fishes in market are preserved by formalin and other preservatives in Bangladesh [6]. A solution of 35 to 40 per cent of water in formaldehyde or methanol is called formalin. As formalin is a strong disinfectant and tissue hardener, it's used for preserving biological and anatomical specimens. It is also used as an antiseptic in sterilizing surgical instruments [7]. Formaldehyde is an important precursor to many other materials and chemical compounds. In 1996, the installed capacity for the production of formaldehyde was estimated to be 8.7 million tons per year [8]. It is mainly used in the production of industrial resins, e.g., for particle board and coatings. The safety of formaldehyde is very complicated. It occurs naturally and is an essential intermediate in cellular metabolism in mammals and humans[9]. It is not acutely toxic as ingestion of many milliliters is tolerated. The main concerns are associated with chronic (long term) exposure by inhalation[10], and may cause headaches, a burning sensation in the throat, and difficulty breathing and lung cancer [11], trigger or aggravate asthma symptoms[12]. The formaldehyde theory of carcinogenesis was proposed in 1978 [7]. In 1987 the U.S. EPA classified it as a probable human carcinogen, and after more studies the WHO International Agency for Research on Cancer (IARC) in 1995 also classified it as a probable human carcinogen[13]. Further information and evaluation of all known data led the IARC to reclassify formaldehyde as a known human carcinogen associated with nasal sinus cancer and nasopharyngeal cancer [13].

2. History of Chitosan

The history of CS was started when Rouget discussed the deacetylated form of CS. Different researchers have been discussed the need of understand and studying these materials, from better production, purification methods, to the modifications of basic structure and its applications. CS has been regarded as a source of potential bioactive material, but it also has several limitations to be utilized in biological system, including its poor solubility under physiological conditions[14]. Therefore, to overcome these limitations, researchers focused on the derivatization of CS by chemical modifications and partially hydrolyzed CS by enzymatic actions as it contains various reactive functional groups. Chemical modifications of CS structures results in increased solubility in water as well as in organic solvents have been reported by some researchers[15].

3. Chemical structure of chitosan

The chitosan is chemically polymer where the 2-amino glucose is the monomer and it structure is given as

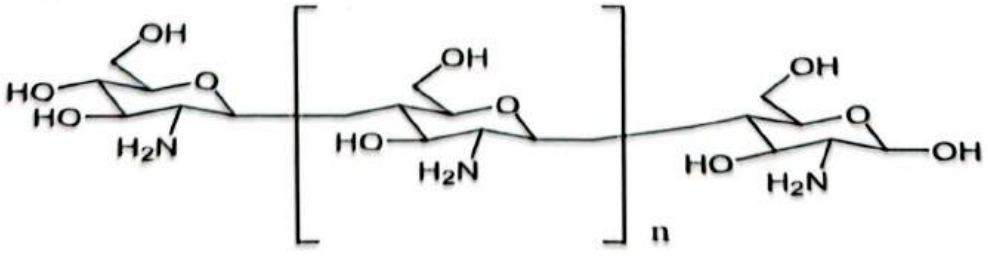

Figure-01: Chemical structure of chitosan molecule

4. Preparation of chitosan

Preparation by chemical methods

The CS was prepared by the reaction of deacetylation [4] from chitin by the following scheme-01. CS is not a single chemical entity, but varies in composition depending on the source and method of preparation and also on physiological conditions. CS could be defined as sufficiently deacetylation of chitin to form a soluble amine salts. The degree of deacetylation must be 80 to 85% or higher or the acetyl content must be less than 4- 4.5% to form the soluble product. Firstly the sources such as crab or shrimp shells are washed and grinded in to powdered form and then it is deproteinized by treatment with an aqueous 3-5% solution of sodium hydroxide. After that it is neutralized and demineralized at a room temperature by treating it with aqueous 3-5% of hydrochloric solution to form a white or slightly pink precipitate of chitin. Then chitin is deacetylated by treatment with an aqueous 40-45% of sodium hydroxide solution and the precipitate is then washed with water. The insoluble part is removed by dissolving in an aqueous 2% acetic acids solution. The supernatant solution is then neutralized with an aqueous sodium hydroxide solution to obtain a purified CS.

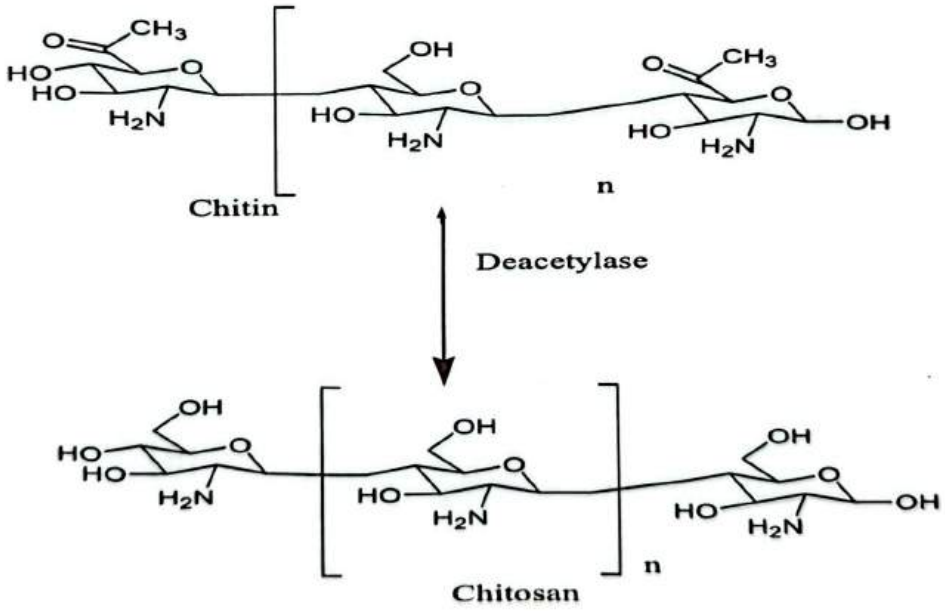

Figure-02: Scheme of preparation of chitosan

5. Properties of Chitosan

5.1 Chemical Properties of Chitosan

CS is a linear randomly distributed, hetero polysaccharide consisting of β (1-4) linked 2-acetamido-2-deoxy- β -D-glucopyranose and 2-amino-2-deoxy- β -Dglycopyranose units. It is prepared by deacetylation of chitin, a linear polymer of β (1-4) linked N-acetyl-D-glucosamine units composed of mucopolysaccharides and amino sugars. The chemical properties of chitosan are as follows:

- Line arpolymine,
- Reactive amino groups,
- Reactive hydroxyl groups available,
- Chelates many transitional metal ions[1].

5.2 Physicochemical Properties:

Generally commercial natural polysaccharides such as, cellulose, carragenans, dextran, pectin, agar-agar, agarose, heparin, alginic acid and many others are neutral or acidic in nature, whereas chitin and chitosan are highly basic polysaccharides due to presence of primary amino group in its structure. This polymer has some specific properties such as polyoxy salt formation, polyelectrolyte complexation with oppositely charged polymers (guar gum, carragenans etc.), acting as a chelating agent, film forming property and specific structural characteristics.[2, 16] The main factors which may affect the CS properties are its molecular weight and degree of deacetylation (DD). These factors enable the researcher to formulate different grades of CS which differ primarily in molecular weight and degree of deacetylation. During the processing of CS from row material, different conditions such as type and concentration of reagents, time and temperature employed can affect the physical characteristics of CS product. The molecular weight of the CS also depends on viscosity, solubility, elasticity and tears strength[17]. In alkaline or neutral medium, free amino group of chitosan is not protonated and therefore it is insoluble in water, while in acidic pH, it gets solubilized due to protonation of free amino groups and the resultant soluble polysaccharide is positively charged. Chitosan forms water-soluble salts with inorganic and organic acids includes glyoxylate, pyruvate, tartarate, malate, malonate, citrate, acetate, lactate, glycolate, ascorbate[2, 4, 14].

Parameters	Description	Ref.
Appearance (powder or flake)	White or yellow	[16]
Particle size	Less than 30 µm	
Viscosity (1% solution/ 1% acid)	Less than 5 cps	
Density	between 1.35 to 1.40 g/cm3	
Molecular weight	50,000 to 2,00,000 Da.	[18]
pH	6.5 to 7.5	
Moisture content	More than 10 %	
Ash value	More than 2 %	
Matter insoluble in water	0.5 %	
Degree of deacetylation	66 % to 99.8 %	
Heavy metal (Pb)	Less than 10 ppm	[19]
Heavy metal (As)	Less than 10 ppm	
Protein content	Less than 0.3 %	
Loss on drying	Less than 10 %	
Glass transition temperature	203°C	

5.3 Biological Properties of Chitosan

Following are the biological properties of chitosan:

- Biocompatible
  - Natural polymer,
  - Biodegradable to normal body constituents,
  - Safe and non-toxic,
    (the research in chitinase is note worthy in this respect)[20].
- Bindsto mammalian and microbial cell saggre-sively,
- Regenerative effect on connective gum tissue,
- Acclerates the formation of osteob last responsible for bone formation,
- Hemostatic, Fungistatic, Spermicidal, Antitumor, Anti cholesteremic, Accelerates bone formation [7, 18, 21].

6 Identification of Appropriate Objectives

6.1 Pharmaceutical industry

6.1.1 Role of Chitosan in Colon Targeted Drug Delivery

Chitosan is a well accepted and a promising polymer for drug delivery in colonic part, since it can be biodegraded by the microflora present in the human colon. Jitendra kawadkar et al. [21] prepared the CS coated microsphere matrix system for the treatment of ulcerative colitis-A. In these study the microspheres of Chitosan Hcl was directly compressed with the drug 5-aminosalisylic acid (5- ASA), into matrices. These matrices were compressed into tablets or introduced into capsules and coated. The release of 5-ASA from these compressed matrices by the polymer degrading action of the caecal microflora was evaluated in vitro using rat caecal microflora in virtue of the similarity with human intestinal microflora and it provides better release of 5-amino salicylic acid in the colon having ulcerative colitis. M.L. Lorenzo-Lamosa et al.[14] proposed the design of microencapsulated chitosan microspheres for colonic drug delivery. He prepared the pH-sensitive multicore microparticulate system containing CS micro-cores entrapped into enteric acrylic microspheres [14, 18, 21].

6.1.2 Chitosan as a Coating Material

Chitosan is used as a coating material in drug delivery applications as it has a good film forming properties and also due to its good much adhesive property. CS as a coating material has many advantages such as controlled release of drug for a prolonged period of time, improvement of drug payloads and bio-adhesive property over the uncoated particles. Shu and Zhu observed the effect of the novel technique in formulating CS beads for controlled release drug delivery. They prepared the alginate beads coated with CS by three different methods. The release of brilliant blue was not only affected by CS density on the particle surface, but also on the preparation method and other factor[22].

6.1.3 Mucosal Delivery

Nowadays nasal, pulmonary drug delivery through mucosal surfaces is receiving a great deal of attention as alternative routes of systemic administration. These surfaces are used to deliver the drug for a prolong period of time at a controlled rate by use of mucoadhesives agent. CS has mucoadhesive properties and it is useful to formulate the bioadhesive dosage forms and can be given through (ocular, nasal, buccal, gastro-enteric and vaginal-uterine) route. Nasal mucosa has high permeability and easy access of drug to the absorption site. CS gets protonated in an acidic solution due to presence of free amino group and the resultant soluble polysaccharide is positively charged, which can bind strongly to negatively charged surface such as cell surface and mucosa. Therefore, CS formulation can greatly improve the residence time of drug on tissues and cells and shows sustained release of drugs there, as a result, the bio-availability of drug can be improved, the administration frequency of drug can be reduced.

6.2 Chemical Industries

Due to its physical and chemical properties, chitosan is being use dinavastar ray of widely different product and applications, ranging from pharmaceutical and cosmetic products to water treatment and plant protection. In different applications, different properties of chitosan are required. These properties change with, e.g., degree of acetylation and molecular weight as well.[23] It was also used in to develop the composite scaffolds for tissue engineering, antimicrobial agents, replacement of chemical polymer, dyeing agent and sugar industries [19]. Chitosan act as chelating agent and heavy metals trapper. The great goal of chemical research to the field of nanochemistry and nano particle synthesis where the CS was used to produce the CS based nano particle[24].

6.3 Textile Industry

Derivatives of chitin have been produced and used to important is taticand soil repellent characteristics to the textiles. Intextile industry, chitin can be used in printing and finishing preparations, while the chitosan is able to removed yes from dye processing effluents. Besides these, chitin and chitosan both have made remarkable contribution to medical related textile sutures, threads, and fibres, surface modification of dye and printing and coloring in dye[15, 20, 25].

6.4 Food Processing

Use of chitosan in food industry is well known because it is not toxic for warm-blood edanimals. Microcrystalline chitin (MCC) shows good emulsifying properties, superior thickening, and gelling agent for stabilizing foods. It is also used as a dietary fibre in baked foods.[26]

6.5 Agriculture

Chitin treated seeds (wheat) were found to have growth accelerating and growth enhancing effects. Chitinous additions to the potting mixtures/soil resulted in significant treduction in root not worm in festations and suppression of fungal pathogens. The agricultural and

horticultural uses for chitosan, primarily for plant defense and yield increase, are based on how this glucosamine polymer influences the biochemistry and molecular biology of the plant cell. The cellular targets are the plasma membrane and nuclear chromatin. Subsequent changes occur in cell membranes, chromatin, DNA, calcium, MAP Kinase, oxidative burst, reactive oxygen species, callose pathogenesis-related (PR) genes development agents [27].

7 Conclusion:

From the above study of the chitosan and its application in the all fields of chemical industries, textile industries, agricultural field and pharmaceutical industries is the new goal molecule as natural polymer and biodegradable molecule. The use of the CS increases the food industries as food preservatives. Due to safe use in all fields, needs to research in the modification of CS, toxicological studies of CS, method development of molecular design and properties, which give us the new door of sustainable chemical. The study of biodegradable and toxicological data is the set up of green molecule for green chemistry.

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Salient Features, Achievements & Policy Options of Present Microfinance Program in Bangladesh

Munawar Reza Khan*

Abstract: *Micro-finance is a great success story in Bangladesh, specially in the field of empowerment of rural women, income generation in rural areas of Bangladesh and so on. Here in this article, the author has made an attempt to define Micro-finance, salient features of Micro-finance, Achievements of Micro-finance in various sectors, key policy options and conclusions.*

Introduction:

Microfinance has evolved as a potent driver of financial inclusion in Bangladesh with much positive impact on poverty alleviation and other social development indicators. The microfinance industry in Bangladesh started its operations in late 1970s with the objectives of delivering micro financial services among the poor people for poverty alleviation. The industry has evolved from its initial focus on credit, disbursing standardized loan products and collecting obligatory savings to the development of diversified loan, flexible savings and other micro financial products. This sector has now attained maturity and entered into dynamic phase in terms of financial inclusion, positive impacts and sustainability.

In the microfinance sector, total loan outstanding (As on June-2016) is around TK 92,000 crore and savings worth around TK 29,000. This sector accounts for around 9.26 percent of GDP in 2016. The existing theoretical literature attributes the high success of micro finance programs in Bangladesh to peer group micro lending, high density of population, macroeconomic stability and liberal socio-political environment etc. There are four main types of institutions involved in microfinance activities in Bangladesh: (a) Grameen Bank; (b) NGO-MFIs that have received licenses from Microcredit Regularly Authority(MRA); (c) Commercial and specialized banks;(d) Government sponsored microfinance programs (e.g. through Bangladesh Rural Development Board-BRDB, Cooperative Societies and programs under different ministries of the Government). However, Grameen Bank and 10 large Microcredit Institutions (MFIs) represent near 95% market share of microfinance industry.

Salient Features of Micro Finance Program in Bangladesh

- Microfinance is a broader concept than microcredit. The former includes microcredit, micro savings, micro insurance, pension and other financial products provided mainly by NGOs/MFIs among the low-income poor people. However, microcredit is the main product offered in Bangladesh. Credit services of this sector can be categorized into six broad groups: i) general microcredit for small-scale self-employment based activities, ii) microenterprise loans, iii) loans for ultra poor, iv) agricultural loans, v) seasonal loans, and vi) loans for disaster management. Loan amounts up to BDT 50,000 are generally considered as microcredit; loans above this amount are considered as microenterprise loans.

***Deputy Executive Director, BEES, Bangladesh**

- ❖ In delivery of financial services among the poor, MFIs in Bangladesh address the problems of targeting, screening, monitoring and enforcement innovatively. The problem of screening i.e. distinguishing the good (creditworthy) from the bad (not creditworthy) borrowers is resolved by MFIs through formation of groups. Since all borrowers of a group are jointly liable for each other's loan and they know each other in almost all respects, a bad borrower has a little chance to enter into a group. The problem of monitoring is also resolved through joint liability of all members of a group as well as close supervision of MFI's staff. Borrowers under joint liability lose right to future credit in case of a default member implying that group members monitor each other and compel debt repayments by threatening to impose social sanctions upon peers who default strategically. Though the poor have no useful physical collateral, peer pressure works as social collateral that makes group members to repay loans regularly. Now MFIs conducts individual based model viz-a-viz group based model in delivery credit.

- ❖ Microcredit is used mainly in off-farm income generating activities. Small business accounts for the highest share (43.02%) followed by livestock (18.11%), agriculture (12.23%), fisheries (4.91%), food processing (3.78%) and cottage industries (3.03%).

- ❖ The geographical concentration of NGO-MFIs in Bangladesh is high in economically advanced region compared to that of the backward region. In December 2016, Dhaka district has shown the highest concentration as usual where more than 189 licensed NGO-MFIs have been operating while Gazipur has the second highest concentration. The lowest concentrations are observed in the four districts i.e. Chagrachari, Bandarban, Rangamati Shariatpur where less than 15 NGO-MFIs licensed from MRA have been operating.

- ❖ According to the size of institutions in terms of the number of borrowers served, MFIs are grouped into four major types: very large, large, medium and small. Two of the very large MFIs, viz., BRAC & ASA and other large 4 MFIs (TMSS, BURO, JCF and SSS) have nearly 54 % coverage of clients and control over 57 % of financial portfolios.

- ❖ Although the fund composition of NGO-MFIs is shifting, total fund has increased over time. Previously donor driven NGOs are now increasingly trying to become more dependent on local fund with the decline of foreign fund, which stood only at 2.9percent in June 2016. Savings from the clients (31.15 percent) and surplus income from microcredit operations (22.89 percent) appeared as two major sources of fund in 2016. Funds from Palli Karma Shahayak Foundation (PKSF) accounts for 16.08 percent, Government owned Wholesale Fund and the commercial banks together accounts for 29.88 percent.

- ❖ Most of the NGO-MFIs' capital adequacy ratios are generally high as their repayment rate is very high, but for few of them the ratios are very low which could be a cause of concern for the sustainability of these NGOs.

- ❖ Top ten MFIs have higher portfolio yield, interest rate spread, return on assets, operational self-sufficiency and financial self-sufficiency, which indicates that these top NGO-MFIs have better financial performance. The average portfolio yield of 582 NGOs (2008 to 2016) is 29.71 percent whereas average portfolio yield of top ten NGOs is 42.02 percent which is higher as they are bigger MFIs.

- A total of 16NGO-MFIs have negative net surplus. There are different reasons for the negative surplus, the major causes of losing are: (i) High staff salary (ii) Low repayment rate (iii) Low service charge realization (iv) High loan loss provision (LLP) (v) High depreciation charge and (vi) Poor fund management.

- Microcredit Regulatory Authority (MRA) is the watchdog of microfinance industry in Bangladesh established by the Government of the Peoples' Republic of Bangladesh under the "Microcredit Regulatory Authority Act -2006" to promote and foster sustainable development of microfinance sector through creating an enabling environment for NGO-MFIs in Bangladesh. As the statutory body, MRA monitors and supervises microfinance operations of NGO-MFIs. License from the Authority is mandatory to carry out microfinance operations in Bangladesh. The number of NGO-MFIs licensed from MRA stood at 700 +at the end of 2016.

Achievements of the Sector

There is a close nexus between finance and growth as many seminal imperial works reveal. Providing easy access to financial services among poor by MFIs and other institutions brings myriads benefit in Bangladesh, the birthplace of modern microfinance of the world. The positive impact of micro finance on the lives of the poor people are furnished below.

Potent Driver of Financial Inclusion for the Poor :

In Bangladesh, MFIs are the most powerful diver of financial inclusion that leads to greater asset accumulation by the poor, their ability to smooth consumption and cope with external shocks. The Bangladesh Household Income and Expenditure Survey, 2015 reveals that MFIs including Grameen Bank are the dominant sources of loans for the poor (79.38%). Now about 30 million poor, more than half of the poor are in the financial folds of MFIs. No other institution either public or private has been as successful as MFIs to reach the poor with finance that help them promote income, employment and alleviate poverty.

The amount of microfinance disbursed by MFIs is increasing fast with high recovery rate (more than 98%) in Bangladesh. Not only that the amount of annual microcredit (around BDT 300 billion) disbursed by NGO-MFIs has already outpaced the amount of annual agricultural credit (BDT 170 billion) by state owned and private banks. Obviously, micro credit has evolved the most powerful tool of financial inclusion in rural areas where more than 70% people live. Obviously, MFIs have emerged as the strongest part of rural finance creating momentum toward broadening and deepening of rural financial markets.

Micro credit for Poverty Alleviation via Promotion of Self-Employment:

MFIs have proved that micro borrowers are creditworthy who pay regularly with recovery rate more than 98 percent. In a fact, the key success of microfinance lies in addressing lack of finance faced by the poor in generation of self-employment for poverty alleviation. Microfinance provides small funds for income generating activities and thus it creates self-employment, promotes income and helps the poor to get rid out of the poverty trap. Microfinance also makes consumption smooth for the poor and helps them cope with the vulnerability stemming either from temporary lack of work or natural disasters. Microfinance programs have been able to generate self-employment for near 30 million poor households

❖ Impacts on Human Capital Formation.

Besides micro credit programs, some MFIs conduct non-formal education, health and other social programs which contribute to increase in school enrollment and education of children of poor households. Most MFIs require that the members learn to sign their names. Thus MFIs have been effective in generating relevant skills and social awareness which leads to human capital formation badly needed for socio economic upliftment of the poor. (Rahman 2015; Hossain, 2014, Khandker2012, BIDS 2015).

❖ Employment of Large Numbers of Graduates:

MFIs do not only create self-employment for millions of the poor, these institutes also generate jobs for more than 0.19 million young gradates. The continued tiredless service rendered by thousands of committed and devoted graduates across the whole of Bangladesh has contributed a lot to make the microfinance industry a success one in Bangladesh and the most viable model for financial inclusion of the poor of the globe. Based on information provided for the fiscal year 2016 by 682 NGO-MFIs, microfinance sector has created direct job opportunities for over 156,000 people; 82 percent of them are male and 18 percent are female (MRA, 2014).

❖ Export of Bangladeshi Model of MFI:

The success of grouped based microcredit lending model among the poor in Bangladesh initiated by Nobel Peace Winner Prof. Mohammad Yunus has not confined only in the territory of Bangladesh; its wave has also reached in other developing as well as developed countries of the world creating hope of relief from poverty and social exclusion among millions of the poor. Such success has generated markets in abroad for Bangladeshi large MFIs to sell their service in building MFIs.

Key Policy Options and Conclusions

(1) Expansion of Outreach:

To enhance the outreach in remote area and provide fast services to existing customers, MFIs need cost effective channel. In this case, mobile financial services are the best options. MFIs may establish partnerships with mobile phone operators and banks to reach the unbanked low income people. Presently some MFIs are providing only foreign remittances; other mobile financial services such as deposits, person to person's payments may be launched.

(2) Adequacy of Fund:

MFIs need more funds to serve graduated clients and unbanked poor people. Enhanced supply of funds for graduated clients can be made possible by (a) raising voluntary and involuntary savings of NGOs/MFIs; (b) attracting more funds from commercial banks (c) increasing size of wholesale funds (PKSF);(d) introducing loan guarantee services (e) raising fund from capital markets (f) securitization of income receivables of MFIs. Soft funds for hard core poor may be increased through greater involvement of large MFIs and donor agencies. The present allocations for different ministries/departments of the Government in serving hard core poor must be enhanced. The fund for CSR allocated by private companies must be increased to meet various needs of hard core poor.

(3) Strengthening Supervisory Framework:

The overall strength and capacity of MRA needs to be enhanced significantly in terms of manpower, resource base, geographical outreach and rule making authority in order to make it capable of meeting all of its operational targets. Supervisory works must be streamlined towards ensuring good governance of MFIs, which is vital for financial and operational sustainability. Days are gone for soft loans funds; good governance is a must for commercial funds which needs for maintained continued growth.

(4) Broadening Ownership:

To make MFIs more transparent, accountable and people oriented new measures may be taken to include representative from micro borrowers and nonpolitical highly honored professionals having good grounding on microfinance and its mission.

(5) Diversification of Products:

MFIs must diversify financial products and innovate suitable products for extending horizontal and vertical outreach of microfinance with a view to addressing the financial needs of the poor. Such diversification will ensure viability of MFIs as well as its programs designed for poverty alleviation. All groups of the poor are likely to need financial services relating to savings, credit and insurance.

(6) Rational interest rate:

A crucial factor to attain sustainability is the application of rational interest rate. Someone argue that MFIs set high interest rate in the name of poverty alleviation and the poor people would not be able to break the vicious circle of poverty if interest rate is not lowered. This is not justified. MFIs in Bangladesh charge between 11-13 percent flat interests which is much lower than that of money lender (more than 100%) and BRI (27%) - a successful commercial MFI in Indonesia.

The interest rate of MFIs is high as compared to that of commercial bank since transactions costs are higher in dealing small loans and taking financial intermediary directly to the Poor's doorstep. Surplus generated from this operation is revealed back through the revolving fund in order to be able to serve more clients and enhance loan size. MFIs should charge such interest rate to cover operational cost with a view to achieving sustainability and attracting huge commercial funds into microfinance industry.

(7) Programs for Hard core poor:

They need supports beyond subsidized funds which include food relief, training and health facilities. Already Grameen Bankand large MFIs have taken special programs to address the problems of hardcore poor. But well coordinated area based sufficient programs are required. Each large MFI can be given the lead role in particular economically backward area avoiding overlapping. Government support must also be continued for hardcore poor through enhanced investment in physical and social infrastructures under different Government ministries/departments, and social safety nets.

(8) National Data Base:

There must have a national data base covering major data of all institutions providing microfinance. This needs concerted efforts to be taken by MRA, PKSF and large MFIs. This

database will ensure accountability and transparency in micro finance operations and remove the overlapping problems. MRA may do comprehensive multidimensional credit rating of all licensed NGO-MFIs and make them public regularly.

(9) Strengthening Research and Training Capability:

MFIs are facing many emerging issues that need to be addressed for smooth development of the microfinance industry. To meet the present and future challenges, it is imperative to strengthen research and training capability of MRA.

Conclusion

It is an established issue and fact that Microcredit opens up an opportunity for the poor and their inescapable poverty, particularly the women who have long been considered as vulnerable, oppressed and non-bankable. The innovative idea of Microcredit has proved the fact that the poor are bank-worthy and their long oppressed destiny can be changed through Microcredit. It is a common observation that the Microcredit recipients have become self-reliant and their economic solvency and family income is raised through proper utilization of loans. The Microcredit recipients, especially women, have been able to raise their social and family status through decision–making power in the family level. The idea of group work as strategy of Microcredit operation has further reinforced cohesiveness among the group members. Beyond their weekly meetings regarding repayment of the installments, group members come forward in case of any difficulty and jeopardy to help each other. The group, which has been facilitated by the NGOs, has become a crucial platform beyond meeting immediate needs related to financial borrowing. In times of crisis, group members provides substantial support for each other and as a result conflicts and quarrels among the Microcredit borrowers are less existent and they hardly face problem in paying their installments.

Apart from its immediate economic contribution, Microcredit has challenged the long practiced patriarchal value system in the society by providing women an opportunity to become self-reliant through small enterprises. The revenues that have been generated from investing Microcredit are used for better housing, sanitation and children's education. Thus women have appeared as a real change-maker at the family and community level. It has been proved that Microcredit acts as a safeguard against gender-based discrimination and domestic violence at the family level. The byproduct of Microcredit program as its generates income and creates job opportunity for millions of young people at the village level have further established the fact that juvenile delinquency, drug addiction and many more social offences can be reduced through Microcredit.

Thus it can be concluded that the idea of Microcredit, if implemented and monitored properly, may change the many social parasitic conditions, including but not limited to poverty, unemployment, gender based discrimination, family violence and conflict. The root of many social conflicts and violence faced by the Third World Countries is poverty, which can be genuinely alleviated by providing them an opportunity to fight against their odds, which Microcredit offers. Individuals must not be blamed as passive subjects or victims of poverty, but should be considered as an active agent of social change, if appropriate opportunity, avenue and advantage are provided with. It is no longer just an idealistic envision or dream to have a fair, just and peaceful world, Microcredit, if applied and used properly, can be instrumental in achieving peace, prosperity and overall well-being of the humanity.

Information Security: A Modern Cryptosystem of a Public and a Secret Key

Md. Obaidur Rahaman*

Keywords: *Information Security, Cryptography: Secret Key, Public Key, Symmetric & Asymmetric.*

Abstract: *In this modern world, day by day people are becoming more powerful because of their ability to share their knowledge and information with each other, though they are very far away to each other destinations. This becomes possible only with the help of some communication network, and this network is shared to all. Now, the most important issue that will arise is the security of those knowledge and information from them who are sharing the communication network but not assumed to know that information. So, here we are suggesting a method to hide our information from which it should not know, even if those can capture hidden form of knowledge.*

The term Cryptography is used to provide information security using some cryptosystems and algorithms known as Cryptographic Algorithm. At present, there are two types of cryptosystems are used: Secret Key Cryptography and Public key cryptography in which this goal may be achieved Secret Key Encryption Systems and Public Key Encryption Systems. Also there are two types of Cryptographic Algorithms are used Symmetric and Asymmetric. The proposed Symmetric and Asymmetric algorithm is used to encrypt confidential information that must be transmitted over an insecure channel.

Introduction

Today, throughout the world, the media, the Internet provides a more convenient way of communicating people, although they are far away from each other. Internet is a widely used network that is shared to all. Therefore, security is very important if we use the Internet to transmit sensitive information.

There are various methods and techniques are provided for secured communication. One of those is cryptosystem and cryptographic algorithms. Cryptography is regarded as a branch of both computer science and mathematics. Cryptography is the art of security and the study of the protection or concealment of information. Cryptography is widely used in modern technological applications, such as ATM transaction, Internet banking and many others. Currently, due to the demonization of the old currency, the Bangladesh economy is moving towards non-cash settlements, where a different technologically advanced application will pass, which will be cryptographically armed to ensure confidentiality and security. Information security is preserved using cryptographic algorithms.

Cryptographic algorithms are divided into two types: cryptography of a secret key, sometimes called cryptography with a symmetric key, and cryptography with a public key, also known as asymmetric key cryptography. Here we propose an algorithm that is a symmetric and asymmetric cryptographic key algorithm for protecting information that must be transmitted over an unsecured communication channel.

***Assistant Professor, Department of Computer Science and Engineering, European University of Bangladesh, Dhaka, Bangladesh.**

Secret Key Encryption

Secret key encryption uses a single key to both encrypt and decrypt messages. As such it must be present at both the source and destination of transmission to allow the message to be transmitted securely and recovered upon receipt at the correct destination. The key must be kept secret by all parties involved in the communication. If the key fell into the hands of an attacker, they would then be able to intercept and decrypt messages, thus thwarting the attempt to attain secure communications by this method of encryption.

Secret key algorithms like DES assert that even although it is theoretically possible to derive the secret key from the encrypted message alone, the quantities of computation involved in doing so make any attempts infeasible with current computing hardware. The Kerberos architecture is a system based on the use of secret key encryption.

Public Key Encryption

Public key systems use a pair of keys, each of which can decrypt the messages encrypted by the other. Provided one of these keys is kept secret (the *private* key), any communication encrypted using the corresponding *public* key can be considered secure as the only person able to decrypt it holds the corresponding private key.

The algorithmic properties of the encryption and decryption processes make it infeasible to derive a private key from a public key, an encrypted message, or a combination of both. RSA is an example of a public key algorithm for encryption and decryption. It can be used within a protocol framework to ensure that communication is secure and authentic.

Information Privacy through Encryption

There are two aspects to determining the level of privacy that can be attained through the Kerberos and RSA systems. To begin with, there is an analysis of the security of the two systems from an algorithmic view. The questions raised at this stage aim to consider exactly how hard it is to derive a private or secret key from encrypted text or public keys.

Currently, one of the main secret key algorithms is DES, although two other more recent algorithms, RC2 and RC4 have also arisen. The size (*i.e. length*) of keys employed in processes is considered to be a useful metric when considering the strength of cryptology. This is because, longer key sizes generally make encrypted text more difficult to decrypt without the appropriate key.

The DES algorithm has a maximum key length of approximately 50 bits. Current consensus is that this range of key size yields keys that are strong enough to withstand attacks using current technologies. The algorithms fixed size nature may, however, constrain it in the future when hardware and theoretic advances are made. The RC2 and RC4 algorithms also have bounded maximum key sizes that limit their usefulness similarly.

A major problem associated with secret key systems, however, is their need for a secure channel within which keys can be propagated. In Kerberos, every client needs to be made aware of its secret key before it can begin communication. To do so without giving away the key to any eavesdroppers requires a secure channel. In practice, maintaining a channel that is completely secure is very difficult and often impractical.

A second aspect to privacy concerns how much inferential information can be obtained through the system. For example, how much information is it possible to deduce without explicity decrypting actual messages. One particularly disastrous situation would be if it were possible to derive the secret or private keys without mounting attacks on public keys or encrypted messages.

In Kerberos, there is a danger that the ability to watch a client progress through the authentication protocol is available. Such information may be enough to mount an attack on the client by jamming the network at strategic points in the protocol. Denial of service like this may be very serious in a time critical system.

In pure algorithmic terms, RSA is a strong. It has the ability to support much longer key lengths than DES etc. Key length is also only limited by technology, and so the algorithm can keep step with increasing technology and become stronger by being able to support longer key lengths.

Unlike secret key systems, the private keys of any public key system need never be transmitted. Provided local security is strong, the overall strength of the algorithm gains from the fact that the private key never leaves the client.

RSA is susceptible to information leakage, however, and some recent theoretic work outlined an attack plan that could infer the private key of a client based on some leaked, incidental information. Overall however, the RSA authentication protocol is not as verbose as the Kerberos equivalent. Having fewer interaction stages limits the bandwidth of any channel though which information may escape. A verbose protocol like Kerberos's simply gives an eavesdropper more opportunity to listen and possibly defines a larger and more identifiable pattern of interaction to listen for.

Server Authentication

Kerberos is a system geared primarily towards secure authentication of access requests and identity. It achieves this through a three stage protocol. As clients progress through the protocol they gain more confidence in the server's authenticity based on a protocol whereby a server is deemed trustworthy if it can return a piece of secret information known originally only to the client that is passed as a message to the server. The message is encoded prior to transmission in a key that only the proper destination server can understand.

This general algorithm is applied at first to the main repository, where Kerberos stores copies of every secret key (known as the Key Distribution Centre, or KDC), which is assumed not to have been compromised. In the event that the KDC is compromised, no communication in the system can be trusted until the repository regains integrity.

In RSA, a server is simply another process with a public/private key pair. If a server can understand a message containing some secret piece of information, known only to the originating client initially, that was sent to it in an encrypted form using its own public key, then returning the secret information to the originating client (using its public key) will gain the clients trust. The client may assume that the responding server is legitimate as only the legitimate server could decrypt the original message.

The main sticking point in this protocol is believing whether or not the initial message is being encoded using the correct public key. Often to determine the correct public key for a service (if it is not initially known) a client must ask a public key server. An attacker successfully impersonating the public key server may supply the client with a fake key, claiming that it is the correct public key for the required server when, in actuality, the impostor can decrypt the supplied key and is waiting to steal the messages.

RSA uses 'certificates' that can be attached to a reply to authenticate the public key of the sender. The certificates themselves are trusted because they are issued from a higher authority (a Certificate Authority, CA) whom, it must be assumed, has validated the contents of the certificate.

The trust of the certificate issuer in this situation is similar to the trust required of the key repository in Kerberos. If can be argued that trust can be broken between the client and certificate issuer. If a false certificate is presented to a trusting client, the client has no defenses and may simply believe the false certificate.

The main difference between the two parallel situations is that, loss of trust in a CA does not breech the entire system, as a compromise of the Kerberos KDC would do. Instead, only clients fooled into accepting the fake certificates would be affected.

Data Integrity

RSA, as a public key cryptosystem, supports the notion of digitally signing a document by appending a ``digital signature'' to the main body text of the document. To prove that the signature corresponds to the message body, and hasn't been copied from another of the sender's messages by an impostor, each signature is made message specific by the sender before the message is sent.

A technique called hashing is used to derive a 'unique' identifier (or "message digest") that corresponds to the message being sent. Each identifier is probabilistically unique to the point that it is unlikely that any other meaningful message may map to the same digest. Well known digest functions MD2, MD4 and MD5 are algorithmically strong in the respect that they produce digests that are probabilistically unique within an appropriately wide context.

By encrypting the digest with the private key of the sender, no other person may alter it in transit, except in the unlikely event that they have the private key of the sender. Anyone may decrypt the signature using the sender's public key. This yields the original message digest which can be compared with a hashed version of the received version. If the two digests don't match, then the message has been corrupted or vandalized.

All in all, digital signatures provide an elegant method of detecting unauthorized modifications to information in transit, or even in storage. Performing the hashing operations on top of any standard encryption may incur a cost, but the overall idea is to not have to encrypt bulky general messages in their entirety if they only need protection against modification, rather than against snooping.

The cost of encrypting an entire message would theoretically be larger than the total cost of hashing the entire message into a smaller "digest" and then encrypting that digest. This is only acceptable, however for messages that require protection against modification and not against snooping.

The main limitation of digital signatures is their dependency on an authentic public key. If the receiver is fooled into using the wrong public key then an impostor can craft his own signatures and pass false information.

Kerberos doesn't provide any explicit support for verifying that a message hasn't been tampered with. Because all messages are encrypted with the appropriate keys, the transmissions are assured to be secure within the domain of a particular KDC (provided, of course, the KDC hasn't been compromised).

To communicate outside the domain of it's local KDC, however, a client must validate itself with the remote KDC. Although communication outside the domain is possible, it creates tenuous long links which are possibly more prone to attack. Their size attracts attention and logically there are more points to attack.

To be sure of authenticity, all data transmitted in a Kerberos system needs to be encrypted by the sender using an appropriate key that was gained by communicating with the KDC.

A Comparison of a Public and Secret Key Cryptosystem

The Public and Private Key pair comprise of two uniquely related cryptographic keys (basically long random numbers). Below is an example of a Public Key:
3048 0241 00C9 18FA CF8D EB2D EFD5 FD37 89B9 E069 EA97 FC20 5E35 F577 EE31 C4FB C6E4 4811 7D86 BC8F BAFA 362F 922B F01B 2F40 C744 2654 C0DD 2881 D673 CA2B 4003 C266 E2CD CB02 0301 0001

The Public Key is what its name suggests – Public. It is made available to everyone via a publicly accessible repository or directory. On the other hand, the Private Key must remain confidential to its respective owner.

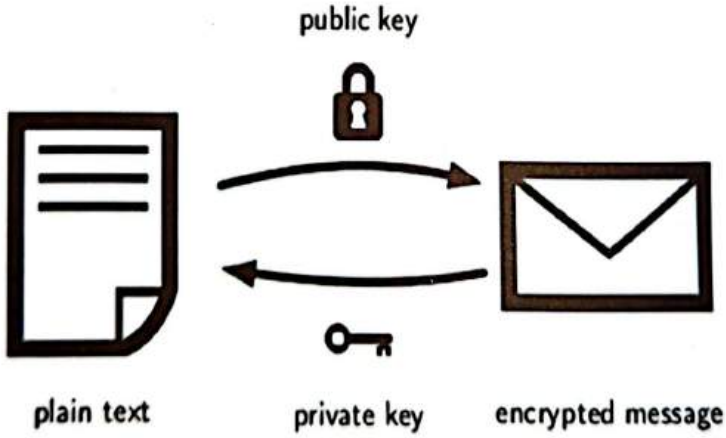
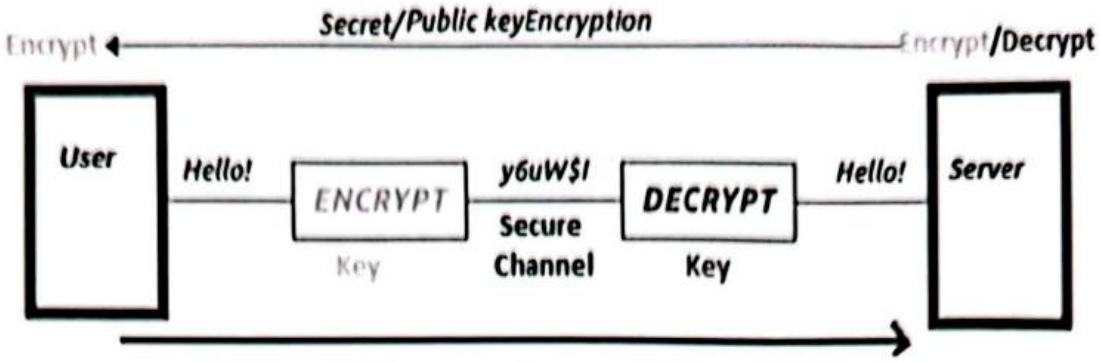


Fig. 1: A Private Key Encryption and A Public Key Decryption Process.

Because the key pair is mathematically related, whatever is encrypted with a Public Key may only be decrypted by its corresponding Private Key and vice versa.

For example, if Sender wants to send sensitive data to Receiver, and wants to be sure that only Receiver may be able to read it, he will encrypt the data with Receiver's Public Key. Only Receiver has access to her corresponding Private Key and as a result is the only person with the capability of decrypting the encrypted data back into its original form.



Fug. 1.1: Private / Public Key Data Exchange Process.

As only Receiver has access to her Private Key, it is possible that only Alice can decrypt the encrypted data. Even if someone else gains access to the encrypted data, it will remain confidential as they should not have access to Receiver's Private Key.

Public Key Cryptography can therefore achieve Confidentiality. However another important aspect of Public Key Cryptography is its ability to create a Digital Signature.

Symmetric and Asymmetric Encryption

Information security has grown to be a colossal factor, especially with modern communication networks, leaving loopholes that could be leveraged to devastating effects. This article presents a discussion on two popular encryption schemes that can be used to tighten communication security in Symmetric and Asymmetric Encryption. In principle, the best way to commence this discussion is to start from the basics first. Thus, we look at the definitions of algorithms and key cryptographic concepts and then dive into the core part of the discussion where we present a comparison of the two techniques.

Algorithms

An algorithm is basically a procedure or a formula for solving a data snooping problem. An encryption algorithm is a set of mathematical procedure for performing encryption on data. Through the use of such an algorithm, information is made in the cipher text and requires the use of a key to transforming the data into its original form. This brings us to the concept of cryptography that has long been used in information security in communication systems.

Cryptography

Cryptography is a method of using advanced mathematical principles in storing and transmitting data in a particular form so that only those whom it is intended can read and process it. Encryption is a key concept in cryptography – It is a process whereby a message is encoded in a format that cannot be read or understood by an eavesdropper. The technique is old and was first used by Caesar to encrypt his messages using Caesar cipher. A plain text from a user can be encrypted to a cipher text, then send through a communication channel and no eavesdropper can interfere with the plain text. When it reaches the receiver end, the cipher text is decrypted to the original plain text.

Cryptography Terms

- **Encryption**: It is the process of locking up information using cryptography. Information that has been locked this way is encrypted.
- **Decryption**: The process of unlocking the encrypted information using cryptographic techniques.
- **Key**: A secret like a password used to encrypt and decrypt information. There are a few different types of keys used in cryptography.
- **Steganography**: It is actually the science of hiding information from people who would snoop on you. The difference between steganography and encryption is that the would-be snoopers may not be able to tell there's any hidden information in the first place.

Proposed Symmetric Key and Asymmetric Key Algorithms:

Symmetrical Encryption

Symmetric Encryption

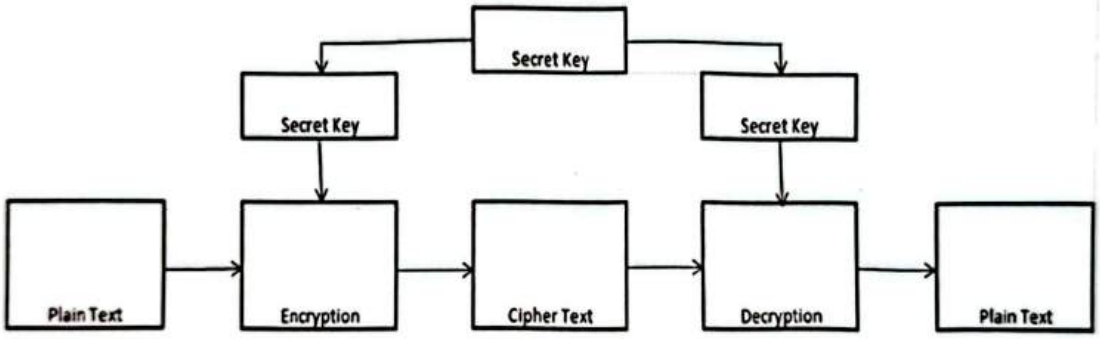


Fig. 2: Symmetric Encryption Process.

This is the simplest kind of encryption that involves only one secret key to cipher and decipher information. Symmetrical encryption is an old and best-known technique. It uses a secret key that can either be a number, a word or a string of random letters. It is a blended with the plain text of a message to change the content in a particular way. The sender and the recipient should know the secret key that is used to encrypt and decrypt all the messages. Blowfish, AES, RC4, DES, RC5, and RC6 are examples of symmetric encryption. The most widely used symmetric algorithm is AES-128, AES-192, and AES-256.

The main disadvantage of the symmetric key encryption is that all parties involved have to exchange the key used to encrypt the data before they can decrypt it.

Asymmetrical Encryption

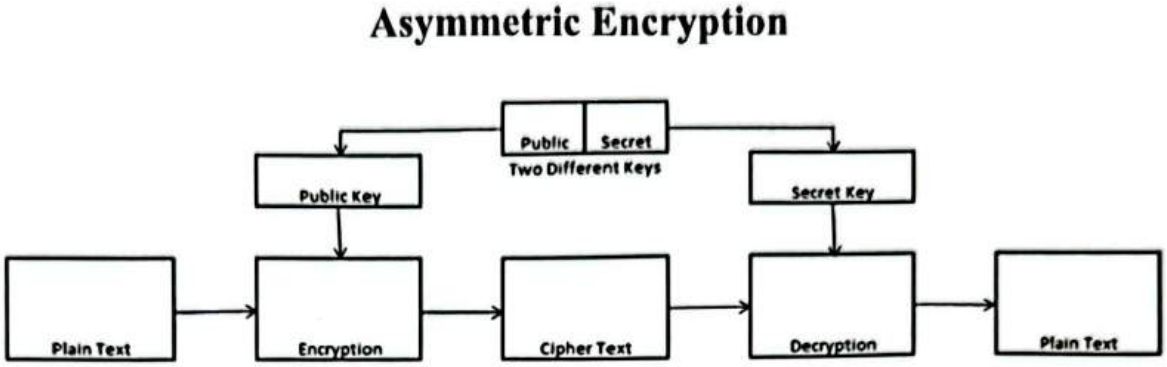


Fig. 2.1: Asymmetric Encryption Process.

Asymmetrical encryption is also known as public key cryptography, which is a relatively new method, compared to symmetric encryption. Asymmetric encryption uses two keys to encrypt a plain text. Secret keys are exchanged over the Internet or a large network. It ensures that malicious persons do not misuse the keys. It is important to note that anyone with a secret key can decrypt the message and this is why asymmetrical encryption uses two related keys to boosting security. A public key is made freely available to anyone who might want to send you a message. The second private key is kept a secret so that you can only know.

A message that is encrypted using a public key can only be decrypted using a private key, while also, a message encrypted using a private key can be decrypted using a public key. Security of the public key is not required because it is publicly available and can be passed over the internet. Asymmetric key has a far better power in ensuring the security of information transmitted during communication.

Asymmetric encryption is mostly used in day-to-day communication channels, especially over the Internet. Popular asymmetric key encryption algorithm includes EIGamal, RSA, DSA, Elliptic curve techniques, PKCS.

Asymmetric Encryption in Digital Certificates

To use asymmetric encryption, there must be a way of discovering public keys. One typical technique is using digital certificates in a client-server model of communication. A certificate is a package of information that identifies a user and a server. It contains information such as an organization's name, the organization that issued the certificate, the users' email address and country, and user's public key.

When a server and a client require a secure encrypted communication, they send a query over the network to the other party, which sends back a copy of the certificate. The other party's public key can be extracted from the certificate. A certificate can also be used to uniquely identify the holder.

SSL/TLS uses both asymmetric and symmetric encryption, quickly look at digitally signed certificates issued by trusted certificate authorities (CAs).

A Comparison of a Symmetric and a Asymmetric Encryption

Symmetric Encryption	Asymmetric Encryption
• Symmetric Encryption consists of one key for encryption and decryption.	• Asymmetric Encryption consists of two cryptographic keys known as Public Key and Secret Key.
• Symmetric Encryption is a lot quicker compared to the Asymmetric method.	• As Asymmetric Encryption incorporates two separate keys, the process is slowed down considerably.
• RC4	• RSA
• AES	• Diffle-Hellman
• Des	• ECC
• 3DES	• El Gamal
• QUAD	• DSA

Conclusion

Security is a broad issue and this report has only addressed a narrow area of techniques that, provided appropriate security policies are defined and adhered to, will facilitate a secure system. The need for adequate security policies, however, is an important issue and worthwhile stressing at this stage. Poor security policies will work to hamper any security mechanisms, no matter how sophisticated and complete those mechanisms appear to be.

When it comes to encryption, the latest schemes may necessarily the best fit. You should always use the encryption algorithm that is right for the task at hand. In fact, as cryptography takes a new shift, new algorithms are being developed in a bid to catch up with the eavesdroppers and secure information to enhance confidentiality. Hackers are bound to make it tough for experts in the coming years, thus expect more from the cryptographic community.

The proposed algorithm is used to encrypt confidential information that must be transmitted over an insecure channel. This algorithm ensures the confidentiality, integrity and other purposes of cryptography until the algorithm and the key are disclosed. This algorithm works at a very low price and is very useful for a small amount of data. Nevertheless, it will work on a lot of data. As we have seen, the key is used for both the encryption process and for decryption, hence it will be classified as a symmetric key cryptography.

The only drawback of this algorithm is that if the algorithm and the key become known to the attacker, then the security of the information will be violated.

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