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SCIENCE VISION

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Commission on Science and Technology for
Sustainable Development in the South

EDITORIAL

COMSATS is bringing out the combined volumes 13 and 14 of 'Science Vision' after a lapse of two years. This issue is a bridging arrangement before the resumption of the journal with a new thematic focus. During the last couple of years, several major changes have taken place at the global level accompanied by varied significant activities that took place in the fields of science and technology, both at the regional and international levels. Economic prosperity, social development and peace have always remained the core elements of sustainable development, while the role of S&T has been a major focus of attention throughout the world.

Worldwide campaigns for sustainable development, particularly of the disadvantaged segment of the world's population, have received considerable attention at international forums. Having realized that sustainable development can only be achieved through a holistic approach and political commitment at the highest level, efforts have been made to lay firm grounds for mutual cooperation between the countries of the South and the North, in order to overcome multi-faceted problems on social, economic and environmental fronts. Moreover, the importance of science and technology as a useful tool for making timely applications of the world's resources have been widely acknowledged and its usefulness in achieving the targets of developing and improving human conditions, have been increasingly emphasized. Ongoing global events demanded much more attention to activities involving worldwide efforts for sustainable development through effective use of science and technology throughout the world; especially in the countries of the South.

To contribute to global development has always been one of COMSATS' top priorities. In order to highlight the contemporary challenges of the developing countries, COMSATS organized and sponsored a number of international seminars and symposia during 2007 and 2008. These focused on addressing the key challenges, faced by the developing world, through the just applications of science and technology. The proceedings of these events were later captured in the form of compilations under the *COMSATS' Series of Publications on Science and Technology*. These were: S&T Policies and Strategies for Sustainable Development; Better Healthcare through Tele-Health; Basic or Applied Research: Dilemma of Developing Countries; Road to Knowledge-Based Economy. Since COMSATS did not bring out any issue of Science Vision during this period, we are publishing a special issue, which is a composite of volumes 13 & 14. The lists of contents and indices of the books published by COMSATS during the previous two years, are given in volume 13, while volume 14 contains research and review papers, devoted to topics in the areas of Agriculture, Medical Sciences, Education and Social Sciences.

Earlier in 2009, COMSATS decided to give the journal a thematic character that would enable it to individually address, through Science and Technology, the dominant issues faced by the developing world and thus provide a more integrated outlook. That is to say that the focus of the journal was shifted from review and research-articles to depicting the role of science in the sustainable development of society and the impact of latest developments in S&T on the economy of a country. The idea was approved by COMSATS Coordinating Council in its 12th meeting held in Abuja, in April 2009. In view of this, volumes 15(1) and 15(2) have been given the themes, *"Environmental Challenges for the Developing Countries"* and *"Renewable Energies: Cleaner and Cheaper Source for World Energy Needs for Development"*, respectively.

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COMSATS' Series of Publications on Science and Technology

BETTER HEALTHCARE *through* TELE-HEALTH

Editors

Hameed A. Khan
M.M. Qurashi
Irfan Hayee

January 2008

The only contents of this particular book given in this compilation are its: Table of Contents, Foreword, Preface, Abstracts, Author Index and Subject Index. The full book, having 110 pages at a price US$ 10 or equivalent, can be obtained from COMSATS Secretariat.

BETTER HEALTHCARE
through
TELE-HEALTH

Editors

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FOREWORD

Like other global inequalities in terms of food security, access to safe water as well as knowledge and information critical for day-to-day life and livelihood, provision of healthcare is marked by a persistent disparity. This is especially true in the case of access to healthcare services. Developing countries are going through a dire health crisis whereby millions of people are underserved in the wake of deficiencies in basic healthcare facilities, access to accurate and timely healthcare, scarce number of health professionals, inadequate health education and awareness, and out of date clinical procedures.

With the emergence of information technologies (IT) in the last century, there has been a growing interest in the role of IT for sustainable healthcare delivery mechanisms. Modern information and communication technologies (ICTs) have been identified as the key components in improving healthcare, and these hold a primary significance in achieving the Millennium Development Goals (MDGs). ICTs have the potential to help improve the standard of health by delivering healthcare information to the healthcare communities, and services to the end-users in developing countries.

Pak-US collaboration in science and technology created the opportunity of training Pakistani doctors in telemedicine applications at state of the art Telemedicine centres of USA in 2003. The idea was to acquire these technologies so that they can be customized to the needs of Pakistan and to produce master trainers for building a human resource in this particular field. Telemedicine/e-health training project was a further continuation of this program in which a model Telemedicine Centre was established at Holy Family Hospital and was linked to a remote hospital in Pindi Gheb. This six months pilot project of US$ 100 thousand worked as the training ground for medical professionals, and 45 doctors and nurses from Rawalpindi/Islamabad got training in telemedicine applications and are now pursuing telemedicine solutions in their own institutions. Moreover the Centre has conducted telemedicine training of hemophilia patients and paraplegics of earthquake. This Centre was identified as the only Telemedicine Centre in Pakistan to provide medical services through telemedicine in the Asian earthquake of 2005. The Centre has organized 4th APT Telemedicine Workshop in Rawalpindi and has continual collaboration with research institutes of USA, UK, India, Japan and Canada. After the pilot project, a recently approved

project under Pak-US collaboration program is conducting telemedicine training at national level and will provide tele-rehabilitation to earthquake paraplegics of Muzaffarabad.

While considering the role of ICTs in the area of healthcare, however, there are many operational, technological, infrastructural, and financial challenges. Above all, we tend to overlook the real needs of the beneficiaries, which vary greatly due to social, cultural and educational differences. To meet these challenges, the efficient use of clinical and technological resources must be optimized and relevant informational resources and the technologies to deliver it must be effectively channelized. The key is to intelligently use modern day technologies to address specific problems and improve on existing ways of working. The full benefit of information technologies will only be apparent when these meet the real needs and add value to the delivery of healthcare services. It is indeed satisfying to note that COMSATS has been one of the first and very few organizations that took an initiative to alleviate and address the problems of healthcare delivery to rural and remote communities of Pakistan through ICTs.

There are many challenges that are yet to be overcome to change the face of healthcare delivery systems in Pakistan, though the pioneering efforts of COMSATS in the field of telehealth are worthy of mention and serve as a benchmark to others working in the field. This publication is a good effort on the part of COMSATS to present the technical talks delivered at the Seminar on Telehealth, organized by COMSATS on 21st August, 2007, and it presents the views and ideas of subject-experts from the field of healthcare. Generally, it discusses issues that are critical to health and useful strategies through which the developing world can benefit from ICTs in the healthcare arena. I am pleased to note that this book talks about the above stated issues in a very balanced and effective manner.

I recommend this book to governmental and non-governmental officials who keep an eye on healthcare sector and healthcare professionals, including doctors, clinicians, paramedics, as well as medical students. I hope this book will surely encourage and coordinate telehealth development within the developing counries. At the same time I suggest people from other walks of life to read this book as a source to increase their learning and knowledge about telehealth in general.

Finally, I would like to appreciate the efforts of COMSATS' entire team working under the guidance of Dr. Hameed Ahmed Khan, the Executive Director COMSATS, for their bountiful efforts in the developmental sector and wish them all the success in their future endeavors.

Prof. Dr. Atta-ur-Rahman, FRS
N.I., H.I., S.I., T.I.
Federal Minister/Chairman
Higher Education Commission &
Advisor to the Prime Minister

PREFACE

The basic objective of sustainable human development, as we know it, is to create an enabling environment for people in terms of quality of health, education and standard of living. This objective, however, is usually pushed aside, particularly in developing countries, in favor of other immediate concerns such as the accumulation of commodities and financial wealth. The fact that health has an important role in enhancing productive capacities that help in accelerating the process of development is generally overlooked. The South, comprising many developing countries and having a quarter of the world's population, is therefore, marked by a weak healthcare-system, and a staggering burden of diseases.

Developing countries around the world share common challenges in healthcare. Fortunately, technology as well as patient and professional acceptance have started to reach levels where telehealth offers a practical and effective solution for delivering healthcare services to people in remote and isolated areas. Until quite recently, telehealth was a relatively new concept, as far as most developing countries were concerned. Today, technology has enabled providers of healthcare to readily share data, images, expertise, and diagnostic procedures, through extensive use of diagnostic equipment, together with multimedia, and videoconferencing capabilities, so that telehealth is no longer an unfamiliar phenomenon. Recent advances in information technology and telecommunications have made telehealth both affordable and feasible. As a result, telehealth has been recognized as a tool that holds the promise to provide equitable access to timely, efficient, and quality healthcare and health information.

Keeping in view the poor state of healthcare in the Northern Areas of Pakistan, COMSATS took the initiative of launching telehealth services in the Northern Areas. A project with the name 'ICTs for Rural Development of Remote and Mountainous Areas of Northern Pakistan', was initiated in January 2004. Its overall objective was to facilitate activities for alleviation of poverty, improve access to specialized health services and IT education and, thereby, contribute towards raising the standard of living in the focused communities, through action-research in the application of ICTs.

Baltistan Health and Education Foundation (BHEF) founded in 1990, has been working to mobilize healthcare services for women in the remote and backward regions of Baltistan. The foundation collaborated with COMSATS to implement and make the first such project in the area a success. International Development Research Centre (IDRC); the Crown Corporation is the principal

funding organization. Introduction of telehealth services in the Northern Areas of Pakistan has provided a breakthrough to a large section of the population through provision of healthcare.

A major concern of the developing countries, however, is to make smart choices and invest wisely in the future use of telehealth, in view of the continued fiscal and human resource constraints on healthcare, in this highly competitive world. Factors such as to determine the impacts, benefits and limitations of telehealth, as well as to devise cost-effective and community-specific programs of telehealth, are other important issues. It was in this background that COMSATS organized a one-day seminar on telehealth in August, 2007, to discuss current trends in telehealth and to propose effective solutions for the future of telehealth in Pakistan. Ultimately the mission of this Seminar was to understand how new technologies could be appropriately employed to improve health in the country. The aim was to learn both from projects now underway and past experiences, with an eye to developing new approaches and initiatives.

Key experts belonging to diverse fields, including health and IT, from across the country participated in the seminar to make it a success. This book is a compilation of the various papers presented during the seminar.

This book is an effort on COMSATS' part to disseminate information and experiences related to telehealth, particularly in various policy-making, healthcare-providing and development circles, and to create awareness regarding telehealth , in general. I am hopeful that this book will help in improved understanding and addressing of health- related issues, through easier and more flexible healthcare-services and support.

I am confident that this publication will prove to be worth every reader's time and attention and will encourage COMSATS to bring out even better and useful publications in future as well. Lastly, I am thankful to all the esteemed authors who have contributed papers in this book, and also to COMSATS' competent team especially Dr. M.M Qurashi, Mr. Irfan Hayee, Dr. Azeema Farid, Mr. Imran Chaudhry, and Ms. Sadia Nawaz for their efforts in compiling, editing and publishing this book.

Dr. Hameed Ahmed Khan, H.I., S.I.
Executive Director – COMSATS

ABSTRACTS

SUSTAINABILITY IN HEALTH AS A POLICY-ISSUE IN PAKISTAN

The notion of 'sustainable development' attempts to create a synthesis of development for conserving economic, natural, environmental or social resources. Pakistan's economy is no exemption to resource scarcity. However, the problem is of missed opportunities, where periods of rapid economic growth in Pakistan were not translated into equally compatible human/ social development.

Pakistan's health sector is striving to improve health outcomes, not only in terms of improvement in the macro-level indicators, but in terms of improvement in access and utilization of healthcare services. Sustainability in health demands that access to healthcare facilities/services is not limited to those with access to resources. Everyone, without exception, should have access to knowledge and information that they need to have a healthy and productive life.

Sustainability in healthcare arena calls for maintaining good health within the scarce resources, that should result in increasing efficiency in attaining good health. Tele-health is a modern way of delivering cost-effective health services and its potential for increasing access to adequate healthcare, despite the distances being great. However, there are issues of outreach, regional differences in healthcare, and delivery. Acceptance by patients and providers of tele-health versus traditional healthcare systems is a challenge. Other problems relate to health related information-technology infrastructure in the country, patients' privacy and a more coordinated health policy that reinforces the use of tele-health as a new mode of healthcare service-delivery.

NATIONAL e-HEALTH POLICY: OPTIONS AND ISSUES

This paper reviews various issues regarding a sustainable e-Health Policy at National Level and various options pertaining to it. e-Health is an umbrella-term which envisages both modes of electronic health-data management, transmission and analysis for diagnostic, education and administrative purposes viz; Health Informatics & Telehealth. e-Health has become a necessity in the Pakistan's healthcare delivery system, in the backdrop of most of her populations living in rural and hard areas, with little or no access to expert healthcare, disparities in the healthcare delivery-facilities in urban and rural areas, neglected women & child health and poverty level above 30%.

There has been governmental, as well as professional group's, interest in eHealth implementation in Pakistan. And some pilot-project had been initiated. But generally it has been observed that these projects failed to produce a 'role model' impact because they either could not be sustained or worked without a clear goal and targets. The causes of such failure include lack of integration in policy-synthesis, among various pilot-projects for sharing of information and experiences and little project- planning documentation.

The author in this chapter points out some important issues relating to policy formulation in implementation e-Health in Pakistan, which include; policy-related issues, organizational and human capacities issues, financial and technical issues. Relevant questions to these issues have also been raised. More importantly, ethical and legal issues, though not discussed at length, yet they are significant at strategic level in current scenario, and need more attention during policy-synthesis.

As Pakistan's healthcare system is influenced by World Health Organization, reference to guidelines of e-Health development-plan at country-level has been made, as major health care advisory partner's perspective.

The author recommends a multidisciplinary approach in composition of Policy-synthesis forum and believes that assessment of user-need is of paramount importance. The exercise should aim at ultimate integrated systems, with standardization and quality elements as a base. Unified coding, health-database language, information-exchange lingua franca and consideration for including local language at some level through development of indigenous and customized solutions can pave the way for growth of effectiveness of e-Health in Pakistan.

PROSPECTS FOR IMPROVING HEALTH IN PAKISTAN, USING e-HEALTH: LESSONS LEARNED AND A PROPOSAL

E-Health, the application of information-technology to improve health and healthcare in less developed countries has great potential, as the infrastructure to support telecommunication increases. This chapter focuses on lessons learned from work done in e-Heatlh in different parts of the world and contains a proposal for using mobile phones to improve healthcare-services in Pakistan.

As Kerr White, one of the founders of evidence-based medicine said, "Have a little statistical compassion and take a look at the evidence before providing inadequate care or wasting millions of dollars." He also said, "Good judgment

comes from experience. Experience comes from bad judgment."

We want to share two lessons that we have learnt about e-Health from our experiences in the healthcare-system in different parts of the world. Those two lessons are:

1. *Look first for simple solutions, using appropriate, available technology: there are e-Health solutions that can improve healthcare that are not dependent on high end-technology*
2. *Evaluation is essential to e-Health. We must be certain that our e-Health solution really works.*

E-HEALTH — THE PANACEA FOR ASIAN HEALTHCARE

E-health can be defined simply as the use of Information and Communication Technology (ICT) in healthcare. The main uses of e-health in developing countries have been to improve access to healthcare services, and enhance the quality of care by making patient-data and other relevant information available to the healthcare providers at the point-of-care. E-health can also provide a medium for economically and socio-culturally appropriate technology solutions available at different points-of-care. The biggest problem at this time is the lack of scientific evidence to convince the decision-makers at the institutional and governmental levels about the benefits of e-health in the local context, and to prove if one technology is better than the other to address the same problem.

PAN Asian Collaboration for Evidence-based e-health adoption and application (PANACeA), is an initiative to generate evidence in the field of e-health within the Asian context, by forming a network of researchers from developing Asian countries. This paper highlights different aspects of this initiatives.

PROPOSING A COMMUNITY-BASED HEALTH FINANCING (INSURANCE) MODEL INTEGRATED WITH E-HEALTH/ TELE-HEALTH

Pakistan's healthcare system is facing many challenges today, including; poorly functional rural health-facilities, low quality of services, poor accessibility and management of service-delivery, low level of public-health allocations and expenditures as compared to regional trends and a higher level of out-of-pocket expenditures. To address these challenges, there is a need to revisit the healthcare policy and strategy. The focus of this paper is on alternate healthcare-financing to increase financing options for closing the resource-gap, encouraging public-private partnerships, accessing new resources and technologies, increasing

participation of community and developing strategies to help implement effective interventions at the local level.

One such intervention is to appropriately benefit from health-information technology and the proposed model is a community-based health financing/ insurance, integrated with health-information and communication-technology (e-health/telehealth). According to this model, the services will be provided through a health-card system. The advantages of the proposed model include; alternative forms of risk-pooling (informal sector) that will reduce economic barriers, reduce out-of-pocket payment, extend traditional arrangements, enhance community-empowerment and community mobilization, raise combined/ collective voice, start the process of dialogue with the community and reduce out-of-pocket expenditures, while increasing the utilization of services.

EXISTING EVIDENCE TO TELEHEALTH AND ITS SCOPE IN DEVELOPING COUNTRIES

Telehealth has been around for over 10 years. A lot of projects have been carried out and many evaluation studies have been undertaken related to telehealth. The studies have been in the domains of user-satisfaction, economic benefit and clinical outcome. Meta-analysis and reviews on these studies have been performed to obtain an overall understanding of the evidence from the evaluations. The evidence has shown to have either mixed or negative results of telehealth. There is a need of further evidence to prove that telehealth is beneficial. At the same time, however, we should understand that the context and objectives of telehealth projects undertaken so far have largely been in the developed countries, which tend to be different from those of developing countries.

POTENTIALS FOR THE FUTURE OF TELEHEALTH AND EXPERIENCES IN BALTISTAN

To those not familiar with our healthcare initiative in Baltistan: I assisted my late wife, Dr. Nasima Rahman, a Pakistani medical doctor to build up healthcare services since 1989, particularly for women and children. My services were first with a clinic, training, medical field-camps and a school health program, in Skardu, and since 1997 in Khaplu, District Ghanche. We (BHEF) took over in 2003 the management of the Abdullah Hospital of the Jabir-Bin-Hayyan-Trust at Skardu, where we established a telehealth facility 2004 (with the technical assistance of COMSATS) and financial assistance of the Canadian development agency, the International Development Research Centre (IDRC) our Telehealth

Clinic. The initiative has been fairly successful and beneficial for the people fo remote rural population. It has also led us to new learning and experiences making way for even better service quality and opportunities to explore.

TELE-HEALTH: A SUCCESSFUL EXPERIENCE IN NORTHERN AREAS OF PAKISTAN

COMSATS, an international and intergovernmental development organization, is the pioneer in Pakistan in the field of telehealth – the unique tool to provide healthcare when distance and time are a great challenge. Since 2001, COMSATS has been involved in initiating multiple telehealth ventures in different parts of the country, including the remote, cold and long neglected Northern Areas of Pakistan. These ventures have been most successful on both grounds – technical and cultural.

COMSATS' accomplishment of telehealth services is a major milestone in the provision of healthcare in a developing country like Pakistan especially while considering that, firstly, these projects were implemented in difficult terrain and weather conditions; secondly, the technical infrastructure was initially nonexistent; and thirdly, and most important of all, in an environment of extreme conservatism. Despite all odds, COMSATS' battle against poverty, disease and illiteracy carries on.

MAKING E-HEALTH BORDERLESS: EXPERIENCE OF TELE-RADIOLOGY LINK BETWEEN AGA KHAN UNIVERSITY, KARACHI, AND FRENCH MEDICAL INSTITUTE FOR CHILDREN, KABUL, AFGHANISTAN

The paper discusses an e-Health based project that is implemented at a tertiary health facility, the Aga Khan University Hospital, Karachi, Pakistan, as well as at the French Medical Institute for children, Kabul, Afghanistan. The fact that e-health can benefit people across geographic boundaries and have radiology services can be provided through the means of telecommunications are presented in the paper.

ROLE OF SATELLITE COMMUNICATIONS IN TELEMEDICINE DURING BAGH EARTHQUAKE IN PAKISTAN

The effectiveness of emergency, diagnostic and pre-operative telemedicine during disaster-relief operation is the major field of interest discussed in this paper. An example of the effectiveness of telemedicine is given, to emphasize the role

telemedicine can play to bridge the gap between the tertiary-level healthcare setups and the primary-healthcare facilities.

This paper highlights the role played by the remote telemedicine units in supplying the expert medical consultation during the post-disaster rehabilitation and medical follow up of the patients.

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COMSATS' Series of Publications on Science and Technology

S&T POLICIES AND STRATEGIES FOR SUSTAINABLE DEVELOPMENT

Editors

Hameed A. Khan
M.M. Qurashi
Irfan Hayee

August 2008

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S&T POLICIES AND STRATEGIES FOR SUSTAINABLE DEVELOPMENT

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FOREWORD

Human history is full of events and eras whereby humanity in general was faced with grave challenges for survival, be these in the form of natural calamities, social needs, or economic conquest. The human struggle has been going on since long and has seen the ups and downs of individuals, groups and nations who have or have not equipped themselves with the right tools and skills from time to time. This struggle for the survival of the fittest is still on, and it challenges only the ones that have a realization for it, while others would succumb to their ultimate fate in the wake of being literally 'resource-poor', viz both intellectual and infrastructural capacity.

The overwhelming mass of 'scientific knowledge' of today is the real essence of all the human struggles. It is the product of precise planned, patient, potential and prosperous cognitive endeavors made over centuries for improving the state of life and adding the meaning of quality to it. The impetus in this human struggle was built with the paradigm-shift in focus and efforts towards generating and gaining scientific knowledge and developing technologies to serve the interests of a group, a nation or a region. The role of science and technology is now well-established as 'rescue agents'; however, there still is a necessity of awakening and enlightening us to 'rescue from what?'.

It is only in the relatively recent past that humanity as a whole has given itself the title of 'one nation', after the realization that we are rapidly consuming the endowed resources of our planet earth, in an unsustainable manner, and using it to nullify the progress of others. It was after all this understanding of many years of struggle by humanity that we have resolved to 'live and let live' and coined the term, 'sustainable development' in the first earth summit in Rio de Janeiro, thus insisting on the paramount role of science and technology. It was for the first time that the concept of planning at global scale was initiated and documented in the form of 'agenda 21', Millennium Development Goals, etc.

Having said this and taking account of our brief history, man appears as the only species with intellect and the skill to survive and prosper. We must plan and coordinate our developmental activities accordingly, as responsible states and nations. The issue of progress and development now has gone beyond the boundaries of national development, though it has roots in local empowerment and social justice. The discussion on this broad domain of "S&T Policies and Strategies for Sustainable Development' has now attained great importance and drawn the attention of the 'most influential' (the developed world) and 'most needy' (the developing countries) equally. It is a high time to ponder practicably and prepare ourselves appropriately to meet the challenges of the present day, as well as ensuring a prosperous future.

This realization being the need of the hour, I am pleased to say that this book by COMSATS is a timely effort to highlight the important issues of S&T policy-planning,

and gives useful directions to address the same. This compilation of valued contributions from experts in various fields of Science and Technology gives good insights into the subject and explicitly defines guidelines for a sound S&T policy-framework, keeping in view the perspective of developing countries. I must say that this book is a crucial step towards reinforcing the need to develop and implement effective S&T-policy in the developing countries. The understanding of the importance of S&T policies and strategies comes with a responsibility to devise sound plans for formulation and implementation of S&T policy. This book establishes a base for the scientists and S&T policy-makers to identify and devise proper framework, according to the point of view of developing states.

I must appreciate the pro-active role of Dr. Hameed A. Khan, who has always given leadership and shown resolve to come up with useful scientific publications from the platform of COMSATS, which itself is motivated and commissioned to undertake scientific initiatives with a regional perspective. I must also applaud the group of authors who have contributed to the content of this publication and done justice to the topic. The admiration is also for the team of professionals at COMSATS, who with their marathon efforts have been bringing out a series of such publications.

Finally, I recommend this book to the scholarly and policy-making circles of developing countries.

(Dr. Ishfaq Ahmad, ***N.I., H.I., S.I.*****)**
Advisor Planning Commission on
Science & Technology, Govt. of Pakistan

INTRODUCTION

Science and technology have led the world towards innovative solutions to today's multi-faceted challenges, at the same time, providing the foundation for economic growth and development and safe guarding the degrading ecosystem. Breakthrough advances in the fields of information technology, biotechnology, materials sciences, health sciences, renewable-energy technologies and other scientific areas, in the last few decades, have revolutionized our way of living, and have upset the power structures for those who pursued excellence in science and technology and shifted it towards sustainable development.

The first and foremost need is to realize and assert the importance of science and technology for achieving sustainable human development. Thereafter, this will help in taking corrective measures in addressing critical issues, such as the available skill-sets of personnel, infrastructural capacity, funding options, institutional networking, and regulatory framework to conduct scientific research and carry out technological development.

To meet the challenges of our globalized economic systems, we need to commit ourselves to the development of human-capital and ensure sustained learning-process within the public and private institutions to foster a culture of innovation. It is essential to direct the policies concerned with the development of human-capital, science and technology and innovation towards improving the scientific-base, raising per-capita income, generating employment and alleviating poverty.

In order to fully exploit the benefits of science and technology, proven to be the engines for sustainable development, third-world countries need to devise policies that would promote science and technology, as well as mobilize S&T resources from across the globe and link them with their respective national systems. For this purpose the institutionalization of S&T under a sound policy is required for proper planning and for laying the foundation of S&T system of a country, as well as for effective execution of S&T activities. There is a strong need to develop coherent and relevant S&T policies across the developing world, through formal institutions that can provide the base necessary for formulating such plans and policies that are capable of influencing the very terms in which policies are conceptualized and implemented.

The debate about sustainable socio-economic development has given additional complexity in the understanding of policies and strategies. Most of the developed and some developing countries are well aware of the complex mosaic on which they have to formulate their clear vision regarding suitable policies and strategies to be adopted on sustainable socio-economic development. However, in the continuously changing

international socio-political environment, and due to internal problems, many developing countries find it extremely difficult to formulate firm policies and plans workable for longer periods of time.

The various sections of this book have been compiled, keeping in view the above-stated realities. This compilation is a humble effort on the part of COMSATS to highlight and address issues relating to long-term S&T policy-making and implementation in the developing countries. It is necessary for me to formally acknowledge the efforts of all the authors and co-authors of this book. Also, I would like to particularly express my gratitude to the team at COMSATS, who has made all out efforts in editing, composing and designing this book, especially Dr. M.M.Qurashi, Mr. Irfan Hayee, Ms. Sadia Nawaz and Mr. Imran Chaudhry.

I sincerely hope that this book fulfills the objectives with which it was conceived, that is, of disseminating information on issues related to S&T policy in the developing world, particularly in various policy-making and development circles. I am hopeful that this book will prove to be worth every reader's time and attention as well as encourage COMSATS to bring out even better and useful publications in the future.

(Dr. Hameed A. Khan, *H.I., S.I.*)
Executive Director - COMSATS

ABSTRACTS

MOBILIZING SCIENCE & TECHNOLOGY FOR SUSTAINABLE DEVELOPMENT: THE ROLE OF S&T POLICIES

The importance and significance of science and technology as ever-growing and useful phenomena along with their central role in the development, growth, productivity and prosperity of the world is a globally accepted idea. Today, more than ever, science and its applications in the form of technology are indispensable for development. Science has contributed immeasurably to the development of modern society and the application of scientific knowledge continues to furnish powerful means for solving many of the challenges facing humanity.

The knowledge-divide has been perpetuated by the uneven, insufficient, or, at times, non-existent financial resources and a lack of sound technical and human capacity to support it. The work of scientists in developing countries is often obstructed by poor infrastructure, fewer opportunities for collaboration and prohibitive investments in research. Inadequate policy-frameworks are another contributing factor.

The capacity to mobilize and use science and technology (S&T) resources is increasingly being recognized as an essential component of strategic planning for sustainable development, and this much needed capacity comes from knowledge and information. Efforts to mobilize S&T for sustainability are more likely to be effective when they are directed to overcoming the boundaries set by the 'knowledge divide' and 'digital divide'.

SCIENTIFIC CULTURE: A PRE-REQUISITE FOR SUSTAINABLE DEVELOPMENT

Education in science is not just about learning the laws of nature and to be able to manipulate it, more importantly it should inculcate in us the scientific spirit. To be able to analyze, think objectively, act rationally, not to take anything on face-value, to doubt, to question and to challenge authority, are some of the hallmarks of a scientific culture that a quality education should inculcate. It is this lack of a scientific culture and not necessarily a lack of education that has turned us into a society that is a victim to blind dogmatism, debilitating traditionalism and irrational fanaticism, a society prone to emotional and irrational acts. In this chapter we discuss this lack of scientific culture and creative thinking in general in the Islamic World with particular focus on Pakistan. Some remedial measures are also presented. It is presumed that a society based on a scientific outlook will be inherently more dynamic, progressive, forward-looking and self-sustaining

"Hardly anyone can understand the importance of an idea: it is so remarkable. Except

that, possibly, some children catch on. And when a child catches on to an idea like that, we have a scientist. These ideas do filter down (in spite of all the conversation about TV replacing thinking), and lots of kids get the spirit - and when they have the spirit you have a scientist. It's too late for them to get the spirit when they are in our universities, so we must attempt to explain these ideas to children". (Richard P. Feynman 2001).

BUILDING INFORMATION-SOCIETIES IN THE DEVELOPING COUNTRIES TO MEET SOCIO-ECONOMIC CHALLENGES OF THE 21ST CENTURY: SOME POLICIES AND STRATEGIES

The emerging challenges of the 21st century facing the developing world in particular can be successfully confronted through the aegis of information and knowledge networking. Information and Communications Technologies (ICTs) provide effective means to build information-societies and knowledge-based economies for addressing our socio-economic issues of illiteracy, lack of awareness, health, population explosion, food insecurity, as well as a poorly developed industry and low gross national products (GNPs).

The three sets of activities, i.e., Infusion of knowledge in the societies, application of appropriate S&T to the development projects, as well as creation of sustainable information societies, provide the foundation for reasonably prosperous societies. Creation of sustainable information-societies is the need of the hour, which in fact gives impetus to development by channeling and appropriately directing the most on-time and up-to-date information to the decision-makers and executing agencies.

Building information-societies is not a rapid process, it is therefore necessary that sustained efforts must be made by governments and participation of private enterprises and other members of the society should be ensured. Also sound policies and planning should be made for building infrastructure for ICTs, training and educating human resources in this domain, as well as establishing knowledge centers and information-hubs to take the central roles through networking.

COLLABORATING FOR SUCCESS

Among the first to navigate across the newly flat globe have been groups or collaborations of basic scientists, most notably those requiring large investments in equipment and specialized teams. CERN, the noted center for nuclear and particle physics in Switzerland, led the way, with its development of electronic communication needed for research-collaborations making a key step towards the world we see today. As a scientist who has enjoyed and thrived in global collaborations of small to moderate sizes, This paper attempts to distill some of the lessons learned, with the goal of encouraging and mentoring a wider range of collaborative national, regional, or international efforts, with benefits to be sought in the more local and applied research topics needed for development of nations and communities lacking their own critical masses to solve important

problems.

SCIENCE AND TECHNOLOGY FOR ACHIEVING MILLENNIUM DEVELOPMENT-GOALS

This paper focuses on the role of science and technology in the achievement of Millennium Development Goals (MDGs). All eight MDGs are discussed one by one, with their particular relevance to science and technology. Possible policies and strategies have been suggested for the developing countries, to help them adopt S&T in accordance with their existing capacities, competencies and resources for achieving millennium development goals and to prioritize MDGs according to their specific national priorities. Such evaluation is primarily based on the available statistical data for the specific country. The example of Pakistan is used to illustrate this approach.

The role and importance of science and technology in the socio-economic uplift is also highlighted with examples, to show how science, technology and innovation are helpful, and how developing countries can achieve socio-economic development.

POLICIES AND STRATEGIES FOR SUCCESSFUL PROJECT-MANAGEMENT ATTRIBUTED TO SOCIO-ECONOMIC UPLIFT OF THE DEVELOPING COUNTRIES

It is well known that developing countries, as compared to the developed ones, usually lack competencies and capacities to even fully benefit from the S&T assistance and programmes offered by the donor organizations. Well-planned projects are generally the most practicable tools to implement the programmes successfully. Any set-backs in the implementation of the projects adversely affect the qualitative, as well as quantitative outputs of these programmes.

The success of project management largely depends upon policies and strategies devised on the basis of clear definitions and understanding of the various component activities involved. These policies and strategies should be sensible, flexible, practicable and transparent. Cumulative build-up of management experience leading to indigenization will help the countries' capabilities to acquire better opportunities of future international cooperation and this process can repeat itself with sustained efforts, adding incremental benefits for the management organizations of the developing countries.

IMPORTANCE OF S&T POLICIES AND STRATEGIES FOR DEVELOPING COUNTRIES

Science and technology have profoundly influenced the course of human civilization. Science has provided us remarkable insights into the world we live in and the scientific revolutions of the 20th century have led to many technologies, which promise to herald

wholly new eras in many fields. It should be ensured to the fullest that these developments are being utilized for the well being of nations.

The emphasis is on devising policies and long-term plans to justifiably reap the benefits offered by science and technology and to safeguard ourselves and the future generations from the insecurities expected and prevalent today, particularly in the form of poverty, hunger, illiteracy and poor economic growth. This calls for having indigenous National Science and Technology Policy-framework for socio-economic development, in particular for the developing countries. The need of the hour is to fully engage S&T with societal wants, so that all the stakeholders may be involved in a meaningful collaboration.

S&T POLICY AND INNOVATION LEADS TO SOCIO-ECONOMIC DEVELOPMENT AND KNOWLEDGE-ECONOMY: CASE STUDIES OF U.S.A., TURKEY AND S. KOREA

No one can deny that the West has achieved the socio-economic status through the acquisition and application of science and technology (S&T). Science is a big domain and technology is its tool. New technologies are only created through research and innovation. Research in any society is actually spearheaded by the academia, and the impetus to the academia (universities and institutes of higher learning) is provided by the industry in that country. The linkage of the academia with the industry cannot be emphasized enough, because it drives the university students forward into the scientific depths of research needed by the industry for improving processes and products.

The developing world must realize the immense value of S&T research and innovation for creating new knowledge and emerging technologies. The countries of the South have to revamp their existing structure of S&T and innovation so as to bring change in the economy and prosperity of the country.

This chapter presents three typical successful cases of National Innovation Systems (NISs) in a developed and two developing countries. USA represents the case of a developed country, while Turkey and South Korea, being good examples of innovation, amongst developing countries are discussed hereunder.

HEALTH AND ENVIRONMENTAL RISKS FROM POOR WATER-SUPPLY AND SANITATION IN DEVELOPING COUNTRIES - A CASE STUDY OF N.W.F.P., PAKISTAN

Poor quality of water-supply and lack of improved sanitation are serious issues in many developing countries, particularly Pakistan. The ongoing efforts of escalating water-supply and sanitation-coverage might reduce the disease-burden on some people, but usually at the cost of ground and surface-water contamination due to pour-flush-pit

latrines and flush-and-forget sanitation. This is evident from the fact that more than 95% of the wastewater in developing countries reaches to the surface or groundwater without any treatment.

A study was conducted by the authors that aimed to look into water-supply and sanitation issues from the perspective of relevant actors, local practices and personal observations. This Chapter highlights the learning made out of this study. Three villages in the rural North-West Frontier Province (N.W.F.P.) were selected for detail study. The study found that the so-called improved sanitation could not break the faecal-oral pathogen-cycle and there is an urgent need of innovation in the conventional sanitation systems. The water-supply and sanitation institutions are often weak and do not have the capability and intention to holistically address the issue. The policies and regulations are strong and fancy in papers, but could not match the ground realities. It is also not in line with the practices, perceptions, priorities and expectations of local people. There is a need that local people be heard and involved in devising water-supply and sanitation policies, and made solution together with them.

EPILOGUE

Socio-economic development in the poor countries is a complex phenomenon and it becomes more intricate when the country is facing challenges of political instability or of internal and external conflicts. Policies and strategies for any development-plan have a key role in determining its success or failure. The picture becomes further complicated when the concept of sustainable development becomes the part of the equation. World initiatives of socio-economic development, like MDGs, are not yielding the expected results so far due to overambitious and in many ways unworkable policies and strategies. This has created disillusionment among a large number of developing countries who were supposed to be the primary beneficiaries of the MDGs. Is it time to take another look at the policies and strategies being pursued for the last several years? The answer will depend upon the sagacity and vision of the advanced and the developing countries together, bearing in mind that the target date of stock taking is not too far, only seven years away.

The potential contributions of science and technology to the sustainable socio-economic uplift of the developing countries is as important as it is for the developed ones. The developing countries have not yet fully realized the importance of this fact and have suffered a great deal in the past. It will be unfortunate if they remain adherent to this mindset in the future as well. This is the most difficult barrier that the developing countries have to cross, i.e., give adequate place to science and technology in their future policy considerations aimed at sustainable socio-economic development. The present book has provided several encouraging ideas for the policy-makers in the developing countries to cross the aforestated barrier and be fully sensitized to the imperativeness of the inclusion of science and technology in their policy-making processes. Mobilizing science and technology for sustainable development in the developing societies, building-up of a scientific culture and educating the societies on the potentials of information and communication technologies should form the developing society's base, in order to set foot on the road to sustainable socio-economic uplift.

It is usually not easy for the developing countries to formulate appropriate policies and strategies to solve their complex socio-economic problems. The major cause is the lack of capacities and competencies. One cannot imitate the policies and strategies of the successful societies per se, as each developing country has its own specific pattern of socio-economic problems. Sound education and expertise are pre-requisites for transforming the knowledge of other societies to suit the exact requirements of another country. Capacity building and competency enhancement through international cooperation are necessary to achieve such prerequisites.

Policies and strategies must not be intermingled with each other. Policy leads towards objectives or targets which, in turn, are linked to the strategies for their successful achievement. Strategies provide enabling schemes for the fulfillment of a policy and

the objectives. Thus the policies and objectives constitute what is called the design of a project, whereas the strategies will be linked to the implementation or execution of that project. As the projects are major tools in the process of achieving socio-economic progress, they must be handled carefully with full clarity of policies, objectives and strategies. The role of expert management-personnel is of crucial significance in the successful handling of the socio-economic developmental projects. Excellent information, based on the practical experience for project collaboration, as provided in one of the relevant Articles in this book, leads to the conclusion that developing countries can indeed learn a lot from the developed countries so as to manage a successful project on socio-economic development carrying a sizeable chunk of science and technology.

As mentioned earlier, the much sought after MDG's are of major concern to a large majority of the developing world. Some important arguments have been built in the present book on the role of biotechnology and genetic engineering to serve the cause of several MDG's. These specific applications of S&T are expected to emerge as major fields of further research during the 21st century. If these segments of science and technology, alongwith some others, are appropriately included in the policies and strategies of the developing countries, they can bring significant change in the poor societies by reducing poverty, hunger, disease and the devastating impacts due to the environmental degradation. Moreover, health and environmental risks from poor water-supply and sanitation are also discussed thoroughly in the overall context of S&T linked parameters, which should constitute an important part of policies and strategies aimed at sustainable socio-economic betterment of the populations of developing countries.

Case studies are always useful to clearly understand the intricacies of any complex project and its execution, and especially for the policies and strategies, which are inherently linked to these projects or programmes. How others have successfully formulated and executed such policies and strategies provides a useful input in the thinking process of other decision-makers. Although it is not advisable for the developing countries to blindly follow the examples of others, it is often useful that lessons learned in such examples are kept in mind while contemplating a country's own set of policies and strategies. In the present discourse a good deal of discussion on three economies at various stages of development, i.e., USA, South Korea and Turkey, has been provided. This conveys clear message that sound S&T policies and innovation does lead to socio-economic development, provided other relevant parameters are well in place. When read side by side, the above three scenarios reveal how various background paradigms and the policies and strategies stemming out of them are defining the destinies of these nations. The developing countries could learn a lot from these three countries' approach to their socio-economic development, their successes and shortcomings, as well as the effect of integrating the crucial component of innovation in the overall framework of their policies and strategies that are led by science and technology.

Today, the future of both rich and poor countries lies in the equitable distribution of wealth and prosperity in the world. To this end they must be willing to show strong political resolve to work coherently on using the world's resources during this century and agree on ways and means to do that successfully. Policies and strategies must be evolved as early as possible by both advanced and developing nations to help each other in scientific and technological development with judicious flow of benefits in both direction. The advanced countries may formulate policies to transfer knowledge, technology and expertise to the developing countries and provide market access to latters' manufactured products, whereas the developing countries should gear up their resource allocation to education, science and technology, industry-university integration for research and innovation, and provide better working environments for educationists, scientists and engineering, ensuring protection of intellectual property rights, etc. Above all, good governance must be ensured at every level. On strategy side, the developed countries should make unbiased assessment of the efficacy of their past and ongoing mechanisms, assistance schemes and socio-economic projects, with a view to make corrections in the previous stereotyped approaches. They should provide generous opportunities for the scientists, engineers, technicians and managers of the developing countries to get high-quality training in their relevant technical and research organizations.

Indigenization of scientific and technological programmes in the developing countries should be encouraged by the rich nations for several spin-off advantages that would accrue to them from the developing economies. Joint industrial ventures in the developing countries should be enhanced considerably and tactically scattered technical workshops for repairs, maintenance, spare parts stock transports, and other logistical facilities for industrial goods as well as the production units, should be built on profitable locations in all the regions of underdeveloped and developing nations. More technical, financial and managerial facilities should be made available to the developing countries by the developed ones in the areas that are going to be of crucial importance in the near future to both, but more so to the poor countries. A few such areas could be: high food-productivity, clean drinking water, energy security, healthcare and environmental protection. It may take half a century of vigorous and concerted efforts by both the rich and poor countries, with their best science and technology inputs and serious cooperation, before any useful results will start to emerge. Daunting causes such as uncontrolled human population and conflicts will have to be stringently controlled at the global level. National and international strategies involving strong political and technical forces will be required to achieve this. Science and technology will certainly play its positive role, the doubt will only be from the political side.

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SCIENCE VISION

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ASSOCIATION OF INTERLEUKIN-1 POLYMORPHISMS WITH PERIODONTAL DISEASE IN THE MENTALLY RETARDED

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ABSTRACT

Genetic test for a composite Interleukin-1 (IL-1) genotype is being marketed to predict risk for progression of periodontitis.

Aim: To elucidate the effect of genetic variance of inflammatory mediators expression and the influence of microbial expression, as risk factors for periodontitis – inflamation around teeth – among Down's syndrome (DS) individuals, as well as to characterize a new procedure to perform this concept through isolation of DNA from dried blood spots collected on a specific filter paper.

Materials & Methods: Twenty normal volunteers and thirty Down's syndrome (DS) children (comparable of age range,15-20 years old) represented the sample of this study. Their periodontal status was estimated through periodontal examination (full mouth clinical attachment loss measurement, probing depths, plaque index scores, and bleeding on probing). Isolation and detection of certain oral pathogens; A.actinomycetemcomitans, Porphyromonas gingivalis, and Provetella intermedia was performed. Genotype for bi-allelic IL-1A+4845, IL-lB+3954 gene polymorphisms using blood was detected by PCR based methods.

Results: The study clarified that the distribution of IL-1α and IL-1β composite genotype among the normal and Down's syndrome individuals were 30% and 5% & 23.3% and13.3%, respectively. The total IL- 1 (IL-1α & IL-1β) were 35% in the normal and 36.7% in the DS individuals. Results showed significant difference between the total composite IL-1 genotype of allele 2 carriage of IL-1A (+4845) & IL-1B (+3953) of DS and normal individuals. There were significant differences between the two groups (DS and normal) only as regards to colonization of Gram (-ve) facultative rods (A.actinomycetemcomitans) and nearly all microorganisms showed a higher percentage within DS more than normal (A. actinomycetemcoitans were 30% & 5%, respectively, P. gingivalis; 23.3% and 10% respectively and P.intermedia was not detected within normal and detected in 6.7% of DS individuals, In addition, DNA was stable and could be captured on FTA cards when tested by PCR and matched with results detected through ordinary procedure.

Conclusion: The composite IL-1 genotype is associated with the severity of periodontitis and further studies have to be conducted to confirm transmission disequilibrium testing with parental DNA to detect excess transmission of the disease associated with genotypes to the affected off-spring. The use of FTA cards were recommended as a new surveillance tool for molecular techniques. It constitutes a significant improvement in the collection of samples (especially with children and handicapped individuals), as well as ease in sample transport.

1. INTRODUCTION

The etiopathogenesis of the periodontal disease is poorly understood, as it is a multifactorial disease, and individual differences in initiation and progression of the disease are dramatic.

The pro-inflammatory cytokine interleukin-1 (IL-1) is a key regulator of the host's responses to microbial infection and a major modulator of extracellular matrix catabolism and bone desorption. It has been reported that variations in the IL-1 gene cluster on chromosome 2 are associated with increased susceptibility to severe periodontitis (Kyoko, et. al., 2000 and Mc Devitt, et. al., 2002). Therefore, a genetic test was being marketed to predict the risk for periodontal disease progression (Higashi, 2002).

The reason for different inflammatory response among some people more than others in responding to the same stimulus may be speculated as occuring due to the dys-regulated production of IL-1, which over-rides the feedback mechanisms that normally master the dose of inflammation to a level sufficient to fight microbial invasion without long-lasting damage to the tissues involved (Agerbaek, et. al., 2006).

Down's syndrome (DS) individuals often develop severe early-onset marginal periodontitis in early adulthood; however, there is little information available on the microbiology of DS periodontitis (Amano, et. al., 2001). Those individuals (DS) differed in their oral condition, compared with the healthy population and showed more severe periodontal disease which may be related to their immune deficiency (Zaldivar-Chiapa, et. al., 2005). Dried blood samples on filter paper (DBS) represented easily handled, stored, and shipped resources of analysis. These have been used worldwide for the neonatal screening of congenital disorders (Guthrie, 1992). Recently, FTA (Flinders Technology Associates) card was introduced to detect bacterial DNA or viral RNA from different biological samples, such as blood, saliva, tissues (Burgoyne,

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1996). These cards are cotton–based cellulose papers impregnated with anionic detergent and buffer that provide chelating and free radical- trapping properties. FTA cards contain reagents designed to adapt the storage, transport and integrity of samples to kill or inhibit saprophytes during drying or bouts of high humidity (Burgoyne,1996). Moreover, it contains lyophilized chemicals that lyse many types of bacteria and viruses. Most cell types are lysed on contact with FTA, including white blood cells (Devost and Choy, 2000) and bacteria (Lampel, et. al., 2000). Viruses are also inactivated, leaving the nucleic acids suitable for molecular identification (Katz, 2002).

The aim of this study was elucidating the effect of genetic variance of inflammatory mediator expressions and the influence of microbial expression, as a risk factors for periodontitis among DS individuals. Also, it aimed to characterize a new procedure to perform this concept through isolation of DNA from dried blood spots collected on specific filter paper.

2. MATERIALS AND METHODS

2.1 Subject and Samples

A. Subjects

i. Thirty DS children of age range from 15-18 years were selected from "Mentally Retarded School–Dokki area. (Each case was subjected to full clinical anthropometric evaluation, to asses their growth and development).
ii. Twenty normal healthy volunteers of age range from 18-20 years.

B. Samples

i. Blood samples:
Five millilitre of venous blood from all individuals.
Aliquots of sample (50µl) were obtained by finger prick from the same individuals, blotted onto the filter paper (Whatmann FTA cards) (1 cm in diameter) and allowed to air-dry at 20 to 25°C till use.

ii. *Plaque samples:*
Using paper-point, plaque samples were collected from each case and transferred in a tube full of sterile reduced transport media (Thioglycolate broth).

All cases were also examined carefully for oral and dental evaluation as follows:

C. Dental examinations

i. Periodontal examination; probing pocket depth, bleeding on probing, clinical attachment loss and gingival recession (A North Carolina probe was used in the examination).
ii. Clinical attachment levels both measured with a manual probe on six locations around each tooth.
iii. Recorded gingival inflammation using gingival index according to Löe and Silness (1963); the teeth and gingiva were dried and adequate illumination, a plain mouth mirror and number 3 periodontal probes, were used. The probe was used to press on the gingiva to determine the degree of firmness. The probe was used to run along the soft tissue-wall near the entrance of the gingival sulcus, to evaluate bleeding.

D. Scoring gingival index criteria depended on the following investigation:

0 = Normal gingiva
1 = Mild inflammation–slight change in color, slight edema. No bleeding on probing.
2 = Soft debris, covering more than one third but not more than two thirds of the exposed tooth surface
3 = Soft debris, covering more than two thirds of the exposed tooth surface.

Debris covering the surface area was estimated by running the side of the tip of an explorer across the teeth surface.

E. Identifying the routine professional tooth-cleaning procedures

F. Family history

Bleeding disorders, cardiovascular disease or diabetes mellitus, ethnic origins of their parents.

2.2 Analysis of Interleukin (IL-1α and IL-1β) Genetic Polymorphism:

A. DNA extraction:

i. Using whole blood:
QIA amp DNA Mini-kit. QIA En, Ltd, UK (Genomic DNA purification kit) was used for

Table - 1: Total anaerobic count (CFU/ml) in relation to gingival index of individuals tested

Total anaerobic count (CFU/ml)	Normal individuals			Down Syndrome individuals (DS)	
	Good GI	Fair GI	Bad GI	Bad GI	Fair GI
103	0/9 (0%)	0/7 (0%)	1/4 (25%)	3/25 (12%)	0/5 (0%)
104	0/9 (0%)	1/7 (14.3%)	1/4 (25%)	9/25 (36%)	1/5 (20%)
105	0/9 (0%)	1/7 (14.3%)	2/4 (50%)	13/25 (52%)	2/5 (40%)

extraction of DNA from the whole blood, as instructed.

ii. Using filter paper:
Each dried sample was transferred to micro-centrifuge tube containing lysis buffer which is shaken for 5 minutes at room temperature, vortex for 15 sec and centrifuged for 30 sec at 12,000g. This wash step was repeated three times. The pellet was resuspended in TE buffer vortex, incubated for 10 min with periodical vortex, and is set to centrifuging for 2 min. After drying, pellets were ready to be subjected to PCR reaction .

3. ANALYSIS OF POLYMORPHISMS IN GENES OF THE IL-1 A&B

The bi-allelic polymorphisms at position -889 within the promoter region of the IL-IA gene McDowell, et. al., (1995) and at position +3954 (Taq I RFLP) within exon 5 of the IL-1B gene Bioque, et. al., (1995), were determined according to previously described methods.

3.1 Microbiological Analysis

The following Media were used, as instructed:

- Trypticase soy agar (ETSA), Trypticase soy agar supplemented with sucrose, crystal violet and polymixin B sulfate (HLE) and Tryptic soy serum-bacitracin-vancomycin agar (TSBV) were prepared as per instruction.

- Samples were diluted in ten-fold step, with repeat homogenization on vortex mixer at a maximal setting for 10 seconds between successive dilutions. Aliquots of 0.1 ml of the dilution were spread on freshly prepared enriched tryptic soy agar (ESTA), (HLR) and (TSBV). ESTA plates were anaerobically incubated for seven days, HLR and TSBV agar plates were incubated in 5% CO_2 air incubator for five days at 37°C. After the incubation periods, one ESTA plate suitable for counting; CFU/ml were calculated considering the respective dilution factor. The relative proportion of all different colony morph types were determined. Representative colonies of these types were sub-cultured on ESTA and incubated for four to seven days. Characterization and identification were performed based on colony and cellular morphology. Grams stain reaction, phase contrast microscopy for registration of motility, biochemical reactions, agar fermentation pattern, and fluorescence in long wave ultra violet light.

Confirmation was done place by using API (fermentative 29 biochemical standardized enzymatic reactions, which depend on the biochemical properties of the tested anaerobic microorganisms).

Individuals examined were further classified, according to their Gingival-index (GI) score, into good, fair and bad GI score groups.

Table - 2: Percentage of certain bacterial species isolated from plaque samples of Down syndrome individuals compared with normal individuals

Bacterial species	% of different types in normal individuals	% of different types in DS individuals	*Z.score*	*P*
Gram (-) facultative rods *A. actinomycetemcoitans*	(1/20) 5%	30% (9/30)	1.96	0.02
Gram (-) anaerobes *Porphyrmonas gingivalis*	(2/20)10%	23.3% (7/30)	1.3	0.09
Gram (-)anaerobes *Provetella intermedia*	(0/20) 0%	6.7% (2/30)	-	-

4. RESULTS

Table-1 demonstrates the total anaerobic count among all examined individuals. It was noticed that the highest CFU/ml (105) and (104) was counted only among bad and fair gps of both normal and DS individuals. The lowest CFU/ml (103) was found only among the bad GI score gps.

There were significant differences between the two groups (DS and normal) only as regards colonization of Gram (-ve) facultative rods *(A. actinomycetemcomitans)*. Nearly all microorganisms showed a higher percentage within DS more than normal (A. actinomycetemcoitans were 30% & 5%, respectively, *P.gingivalis*; 23.3% and 10%, respectively, and *P.intermedia* was not detected within normal group and was detected in 6.7% of DS individuals (Table-2).

Table-3 reveals that only 11 out of the 30 subjects (36.7%) carried the composite IL-1 genotypes consisting of both IL-1α and IL-1β.There were significant differences between the total carrier of allele 2 from fair and bad GI scores groups (20% with fair GI score and 40% with bad GI score). IL-1α polymorphism was carried by a more percentage than IL-1β 23.3% (7/30) and 13.3 % (4/30) of all subjects tested, respectively.

Table-4 revealed that 7 out of the 20 individuals (35%) carried the composite IL-1.

Genotypes consisted of both IL-1α and IL-1β. There were significant difference between the total carrier of allele 2 from fair and bad GI scores groups compared to those with good GI score group (11.1% of them were with good GI score 42.8% with fair GI score& 75% with bad GI score). IL -1α polymorphism was carried by a more percentage than IL-1β (30 % (6/20) and 5% (1/20) of all subjects tested, respectively.

Table-5 showed a significant difference of the total composite IL-1 genotype of allele 2 carriage of IL-1A(+4845) and IL-1B (+3953) of DS compared to normal individuals DNA was stable and could be captured on FTA cards when tested by PCR and matched with results detected through ordinary procedure.

5. DISCUSSION

Periodontitis is a multifactorial chronic inflammatory disease. However, it is difficult to ascertain the role of the different factors involved in its pathogenesis. Our microbiological study focused on a number of microbial species *(A. Actinobacillus actinomycetemcomitans, Porphyromonas gingivalis,* and *Prevotella intermedia),* which were proposed to be a useful tool for the identification of susceptible individuals (Slots and Listgarten, 1988; Maiden et. al., 1990; and Haffajee, et. al., 1991). Substantial data supported the current concept that specific bacteria were essential for initiation and progression of chronic periodontitis (Page, et. al., 1997). The rates of progression and disease severity were determined by host modifiers, such as smoking, diabetes, and genetic influences.

Schroeder and Lisgarten (1997) suggested that the continuous presence of such large numbers of bacteria probably accounts for varied host defense mechanisms against bacterial invasion and growth that could be found in the gingival tissues. Reports by Marsh and Martin (1999) supported our results that nearly all micro-organisms show a higher percentage within DS as compared with normal (A. actinomycetemcoitans) percentages were 30 & 5 respectively, P.gingivalis; 23.3 and 10 respectively and P.intermedia was not detected in normal cases but

Table - 3: Distribution of composite IL-1 genotype of allele 2 carriage of IL-1A (+4845) & IL-1B (+3953) among examined Egyptian Down Syndrome children divided according to their GI score

Groups according to GI score	IL-1 genotype of allele 2 carriage of-IL-1A(+4845)and IL-1B(+3953		Total carriers of allele 2
	IL-1α	IL-1β	
Fair (GI)gp	1/5 (20%)	0/5 (0%)	1/5 (20%)
Bad (GI)gp	6/25 (24%)	4/25(16%)	10/25 (40%)
Chi square between fair GI and bad GI gp			0.004
Total studied sample	**7/30 (23.3%)**	**4/30(13.3%)**	**11/30 (36.7%)**

Table - 4: Distribution of composite IL-1 genotype of allele 2 carriage of IL-1A (+4845) & IL-1B (+3953) among Examined Normal Egyptian individuals divided according to their GI score

Groups according to GI score	IL-1 genotype of allele 2 carriage of-IL-1A(+4845)and IL-1B(+3953		Total carriers of allele 2	Chi square between goodGI score group and other GI score gps
	IL-1 α	IL-1β		
Good (GI) gp	1 /9 (11.1%)	0/9 (0%)	1/9 (11.1%)	-
Fair (GI) gp	3/7 (42.8%)	0/7 (0%)	3/7 (42.8%)	0.002
Bad (GI) gp	2/4 (50%)	1/4 (25%)	3/4 (75%)	0.0066
Total studied sample	6/20 (30%)	1/20 (5 %)	7/20 (35%)	

was detected in 6.7% of DS. In addition, Sakellari, et. al., (2005) noted that DS individuals displayed more severe periodontal destruction earlier, and a heavier colonization with periodontal pathogens compared with age-matched healthy individuals.

Prevalence of the total IL-1 (IL-1α and IL-1β) polymorphism in subjects of our results of both normal and DS individuals with bad GI score (75% and 40%) almost double those with fair GI (42.8% and 20%) respectively, which indicated that there were evidence of a linkage between severity of periodontal disease and IL-1 gene expression. These results coincided with the findings reported by Di Giovine, et. al., (1996), Salvi, et. al., (1998), Socransky, et. al., (2000), Mary, et. al., (2001) and Laine, et. al., (2002). Genes which encode inflammatory cytokines were subjected to polymorphisms in their regulatory regions that may affect both the level and ratio of cytokines produced in response to exogenous stimuli. These variant alleles were observed in a large percent of the population and are often associated with increased or decreased susceptibility or severity (modifiers) to infectious, immune or inflammatory diseases (Yucesoy, et. al., (2003). Our results correlated the severity of periodontitis to presence of carriers of allele 2 genotype in the IL-1A and IL-1B genes. Our data agreed with Kornman, et. al., (1997) who reported the same correlation and explained this finding as genetic mechanism by which some individuals, if challenged by bacterial accumulations, might have more vigorous immune-inflammatory response leading to more severe periodontitis. Moreover, Kornman (2006) added that monocytes from individuals homozygous for the IL-1 B +3953 allele 2 produce four-fold more IL-1β and heterozygous cells produce approximately two-fold more IL-1β from individuals homozygous for allele-1.

The complex interactions that occur between host-response mechanisms and oral pathogens in periodontal disease have made elucidation of genetic factors in disease susceptibility more difficult (Hassell, et. al., 1995).

Our results showed that, within the sample of this study IL-1α and IL-1β polymorphisms were carried by 30%, 23.3% and 5%, 13.3 % among the normal and DS individuals, respectively, i.e., IL-1α polymorphism was more frequent in our sample than IL-1β. This finding was in accordance to finding of Gary, et. al., (2000) that IL-1β polymorphism was much rare with only 3.3% (10/300) in their study on Chinese population. In contrast, findings of Walker, et. al., (2000) suggested that IL-1β polymorphism was the most prevalent allele in a study of 37 individuals in the general African-American population in Western North Carolina .

There was a concept mentioned that the prevalence of IL-1genotype positive subjects differ according to ethnic populations. It was found to be 26% in a Hispanic Mexican population (Caffesse, et. al., 2002). A higher percentage (38.9%) was observed by (Mary, et. al., 2001) in European heritage.

The present study recommends the use of FTA cards, as it establishes a new surveillance tool for molecular

Table - 5:Chi square for comparison of the distribution of composite IL-1 genotype of allele-2 carriage of IL-1A (+4845) & IL-1B (+3953) among all examined individuals

Total carriers of allele-2 among DS individuals	Total carriers of allele 2 among normal individuals	Chi square
7/20	11/30	0.00005

techniques. In agreement with our recommendation, the studies of Abe, et. al., (1998) and Abe and Konomi (1998) confirm similar results on analysis of frozen serum compared with plasma dried on the filter paper related to the same samples. Moscoso, et. al., (2005) and Elizabeth, et. al., (2006) documented that molecular characterization is feasible in stored samples on FTA under unfavourable environmental conditions (41°C) for at least 15 days. Generally, many scientists preferred this method, due to safety of storage and shipment to laboratory in settings where these issues are problematic. Furthermore, this method is practically valuable for small-volume samples, large population-based studies, in case of problems with cold storage and transportation .

In conclusion, the composite IL-1 genotype is associated with the severity of periodontitis and further studies have to be conducted to confirm transmission disequilibrium testing with parental DNA, to detect excess transmission of the disease-associated genotypes to affected off-spring. The use of FTA cards are recommended as a new surveillance tool for molecular techniques. It constitutes a significant improvement in the collection of samples (especially with children and handicapped individuals), as well as ease in sample transportation.

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VISION FOR DEVELOPMENT OF RANGELANDS IN PAKISTAN - A POLICY PERSPECTIVE

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ABSTRACT

The paper deals first with the importance of range management, then discusses constraints in rangeland development, and finally overviews the recommendations of different expert-forums set-up from time-to-time for the formulation of range policy in Pakistan. The forums gave comprehensive recommendations and suggested creation of an independent range-management agency/ organization vested with authority, responsibility, and accountability, both at federal and provincial levels, for the development of rangelands in Pakistan. However, the implementation of these recommendations is lacking. In addition to the recommendations, other suggestions in the present rangeland scenario have also been discussed for charting detailed and effective rangeland policy in the country.

INTRODUCTION

Total area of Pakistan, including Northern Areas and Azad Jammu and Kashmir, is 87.98 million ha. About 50.88 million ha, constituting almost 58 percent of the area, are rangelands (Mohammad, 1989). Out of this 58 percent rangeland area, only five percent lies in the high-rainfall rangelands of Alpine pastures (1.68 million ha) and Himalayan grazing lands (0.67 million ha). Rest of the rangelands are situated in arid and semi-arid areas of the country where annual precipitation seldom exceeds 300 mm. Due to climatic and topographic limitations, these areas are not fit for other land-uses like forestry or permanent cultivation. Hence, livestock grazing on rangelands constitutes the biggest land-use in the country. Rangelands provide nearly 60 percent of feed for sheep and goats; about 40 percent for horses, donkeys, and camels; and only five percent for the cattle and buffaloes (Zafaruddin, 1985). Based on these estimates, the livestock population, in terms of animal units grazing on rangelands, has been given in Table-1.

Animal population in Table-1 is the estimated figure based on inter-census growth-rate of Livestock Census of 1996 and 2006. From the Table-1, it can be derived that about 19 percent of livestock population is dependant on rangelands. So, the contribution of rangelands in livestock production is significant and it can be at least doubled by managing rangelands on scientific lines. In addition to forage for the livestock, rangelands also have a variety of cultural, ecological, and economic implications for the society. For example, these provide a wide array of goods and services, such as: water and habitat for wild and domesticated animals; clean water for cities; open space for recreational activities like hunting, fishing, camping, hiking, and observing wildlife; plants for economic and medicinal use; water for recharging aquifers, through infiltration and percolation; variety of plants for enriching floral and faunal biodiversity; climate moderation; and environment cleaning, are the important ones to be mentioned here. The extent of multiple rangeland-uses suggests that development and conservation of this natural resource is vital for sustainable economic development in the country.

Rangelands, although a potential resource since long, have been experiencing continuous process of land degradation, due to gradual increase both in human and livestock populations coupled with frequent occurrence of profound droughts. Consequently, the fragile arid ecosystems have got disturbed, as evident from the degradation of vegetation cover, the deterioration of soil and reduction in animal productivity. Such a state of affairs is not only adversely affecting human beings, but is also creating environmental and health hazards. This situation has further impoverished the pastoral communities of Pakistan, who are already living in desperate economic conditions. This situation signals the need to investigate and take corrective actions for conservation and enhancement of productivity, sustainability, and ecological health of rangeland ecosystems.

CONSTRAINTS IN RANGELAND DEVELOPMENT

Some of the major constraints encountered in the development of rangelands in Pakistan are given as follows:

i. ***Low-Priority on National Planning:*** Rangelands in Pakistan are victims of neglect and apathetic attitude, both at stake-holding communities and public-sector levels. For example, “Tragedy of Open Access (resource is owned by everyone or no-one, exploitation is open)” prevails among the stakeholders in the utilization of rangelands. Everyone has open access to utilize the resource, but no one is responsible for its improvement. Similarly, at public-sector level, this vast resource is not given due attention. For example, forests cover only five percent of Pakistan’s total land area, but there are well-established and full-

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Table - 1: Animal Units (A.U.) Feeding on Rangelands in Pakistan (in million)

Livestock	Livestock Population 2007-08*	AU** Equivalent	Total A.Us	% Grazing on Rangelands	AUs Grazing on Rangelands
Cattle	31.8	1.0	31.80	5	1.59
Buffalos	29.0	1.5	43.50	5	2.18
Sheep	27.1	0.2	5.42	60	3.25
Goats	56.7	0.3	17.01	60	10.21
Camels	1.0	1.7	1.70	40	0.68
Horses	0.3	1.3	0.39	40	0.16
Asses	4.4	0.6	2.64	40	1.06
Mules	0.2	1.0	0.20	40	0.08
			Total: 102.66		**Total: 19.21**

*Source: Pakistan Economic Survey 2007-08 (GoP, 2008).
**Animal Unit. An A.U is taken as a young cow weighing about 425 kg and consuming nine kg of air-dry forage per day.

fledged independent Forestry Departments at provincial and federal levels to take care of forest development in the country. On the other hand, rangelands constitute 58 percent of the land area, but there is still no independent organization or authority that is responsible for the development and management of such an important natural resource. In general, rangeland development is considered a low-priority issue at grassroots level as well as by the planning and development authorities of Pakistan.

ii. ***De Jure and De Facto Rangeland Status:*** In Pakistan, except for a very small fraction of communal and private lands, the Government owns all rangelands. In 1894, the British Government of India adopted a forest policy, in which pastures and grazing grounds were merely counted as one of the four classes of forests (Rafi, 1961). Since then, rangelands have been under the administrative control of the Forestry Department but, in fact, there is no control of the Forestry Department over the rangeland areas, except for a few rangeland sites that are being intensely managed under some project funding. According to the legal status, rangelands are declared as protected forests whereas, in fact, these are open to everyone for unrestricted grazing, cutting, and uprooting of plants.

iii. ***Lack of Independent Range-Policy:*** Although rangelands constitute the largest land-use, yet these have not been recognized as a distinct land-use. Being an adjunct to the Forestry Department, these are not given the required priority in policy and financial matters. Until now, no independent Range-policy has been formulated for the development and management of rangelands. Consequently, we could not make any significant progress towards realization of ecological potential of our vast rangeland resources.

iv. ***Management Issues:*** i) Since rangelands are managed by the Forestry Department, it is considered as a low priority and secondary activity, as compared to forest management. Being comparatively less attractive, tough and difficult job, range-management assignments are not liked by most of the forest personnel. In general, forest workers join range-management duties unwillingly or sometimes as a punishment; hence their performance remains far below expectation. ii) Range improvement and development activities are carried out by the Forestry Department in isolation, without involving grazing communities at any stage of planning and development. As a result, the work carried out by the Forestry Department is not understood and owned by the local communities. iii) Failure to replicate the lessons learnt from the earlier national-level range-management projects, like that of Maslakh Range Project, Quetta, Balochistan. For example, wind-mill technology worked well for livestock-watering, but it was not extended to other similar areas where wind-speed favours the technology. iv) Poor implementation of the governmental policies is another managerial problem. Each year, afforestation campaign is launched across the country and millions of seedlings are planted, yet due to the lack of after-care mechanism at the public as well as private-community levels, it results in almost total loss of the efforts.

v. ***Technical Issues:*** i) Baseline data on soil and range vegetation, including soil depth and nutrient status, plant density, composition, seasonal changes, grazing potential, ecological status, etc.,

are not updated at regular intervals that are important tools for managing rangelands on scientific lines. Application of modern scientific tools like Geographic Information System (GIS) is missing for range inventory and data analysis. ii) Appropriate grazing strategies for different rangeland types have not been developed. Over-grazing and deforestation have badly destroyed range-plant biodiversity and productivity. In many areas, plant cover is depleted to the magnitude that any desirable ecological change/recovery through protective measures may not be possible within a foreseeable time-period. In addition to that, the parching droughts in arid/semi-arid areas adversely affect plant-growth and reproduction, which result in further loss of primary productivity and ecosystem disturbances. iii) Introduction of exotic plants may pose serious threats in the introduced area, as did Mesquite (Prosopis juliflora and Prosopis glandulosa) in Pothohar and other forest plantations. Being unpalatable and having faster growth-rate, it has gradually replaced slow-growing and palatable native tree-species, like Acacia modesta, Olea ferruginea, A. nilotica, Zizyphus spp., etc. Due to Mesquite invasion, the grazing potential of our rangelands has decreased noticeably. iv) Lack of incentives and career development for the highly qualified, motivated and devoted range-professionals is another issue that needs proper attention. Posting of irrelevant technical persons as heads of range-management research units is another bottleneck that slows down the pace of progress. These irrelevant heads do not give priority to range research and development work, which results in deprivation and discouragement of the concerned technical staff.

vi. ***Socio-Political Interference:*** Unnecessary socio-political interference is another compelling and valid reason for range-degradation in the country. It is not uncommon that the tribal or influential people graze their livestock or cut the trees from the rangeland area that is otherwise protected from excercising these rights. Such types of untimely interferences by the local people are not only harmful to the range vegetation, but also demoralize the confidence of the personnel associated with the work of rangeland improvement.

vii. ***Land-Tenure System:*** Since rangelands are a state-owned enterprise, the pastoral people miss the sense of ownership. There is hardly any incentive for them to conserve or develop their own lands.

viii. ***Economic Issues:*** i) Planning and development authorities give low priority to range-development projects, as these do not meet the viability criteria fixed on the basis of direct-economic returns. So, the projects for range-development in the country have remained inadequately financed and, thus , could not have the desired impact on development of rangeland of Pakistan. ii) Inadequate marketing facilities and the mechanism of middlemen deprive the livestock-producer of adequate economic returns. All the marketing processes are in the hands of middlemen. Thus, hardly any facility, like transportation, livestock handling, marketing, and slaughtering, etc., is extended to the livestock producer by the government. This has resulted in low off-take rate and extra build-up of livestock on the already overstocked rangelands. It was estimated in a survey that, due to lack of marketing facilities, services of intermediaries (commission-agent and butcher) represented 32 and 30 percent (for sheep and goats, respectively) of the price paid by the consumer (Mahmood and Rodriguez, 1991).

ix. ***Nomadic Grazing:*** Nomads are another threat to the rangelands of Balochistan and Pothohar plateau. On the onset of winter, nomads start moving from Afghanistan and Himalayan mountains towards the hot plains of Balochistan and Pothohar areas, respectively. This is the most crucial time, as the native flora become dry and the nomadic livestock causes additional loss of the existing vegetation by grazing the left-over range forage. On the other hand, when they start moving back to Afghanistan and Himalayan mountains, at the start of the spring season, the range-plants have just started growth and consumed the reserved carbohydrates in making early growth (FAO, 1983). If plants are grazed at this early-growth stage, these become more susceptible to mortality. Therefore, departure of nomads just on the onset of spring season from the hot plains results in an early defoliation and mortality of the young range-plants.

STEPS TO A RANGE-MANAGEMENT POLICY

In 1894, when the British Government of India adopted a forest-policy, men and cattle were few and grasslands were extensive, having plenty of nutritious

grasses for livestock grazing. At that time, even the protection of pastures and grazing grounds was considered too expensive to justify their control by the Forest Department. However, soon after independence, the Government of Pakistan recognized the need of scientific management of rangelands. A start in this direction was made during 1954 with the initiation of Maslakh Range and Pasture Improvement Scheme near Quetta. The scheme served as a demonstration of suitable range-management practices and also as a training-ground for the forest technicians involved in range-management.

From time to time, the Government of Pakistan has issued a number of policy directives and recommendations for the effective management of rangelands in the country. The Ministry of Agriculture and Works, Government of Pakistan, issued the first Range Policy Directive in 1962. In this directive, the government recommended the leasing out of ranches for development purposes. They felt that the development of rangelands should be programmed on the basis of associating the public through: the allocation of land to private parties with credit facilities; assistance in exploration of underground water, and sinking of tubewells; provision of technical know-how for livestock rearing, and pasture-development; provision of medical and veterinary facilities; and also through the establishment of better marketing, especially through cooperative efforts. They also realized that normal facilities necessary for settling people in new lands should be extended to areas of this type.

In 1964, CENTO emphasized the need of a range-management policy for Pakistan. They recommended that government should define the types of public lands that should be used for range purposes. They recommended restrictions on the conversion of rangelands, which are sub-marginal for agriculture, to agri-lands. The First West Pakistan Range-Management Conference was organized by Pakistan Forest Institute (PFI) in 1966 (CENTO, 1964). The Conference recommended the formation of 'Grazing Advisory Committee', including representatives of public at provincial, divisional, and district levels, to lay down outlines of range-management policy and programme and to look for ways of the implementation of these decisions. Unless a range-management policy is framed by associating the representatives of the public, it would not be practicable in the field (PFI, 1966).

In 1971, CENTO especially invited the attention of the Government of Pakistan and stressed the urgent need for a national range-management policy that should give full regard to the diversity of conditions in Pakistan. They emphasized the importance of the formulation and implementation of range-management policies with free and open-minded dialogue between government officers and livestock owners (CENTO, 1971).

The Minister for Food, Agriculture and Under-developed Areas, Government of Pakistan, formed a National Range-Management Committee in 1973. The Committee suggested the creation of independent and effective organizations at provincial as well as central levels for the development and management of vast rangeland resources. They also recommended suitable economic incentives to enlist people's cooperation and to encourage their participation in range-management programmes (GOP, 1973).

In 1983, the Minister for Food, Agriculture and Cooperatives, Government of Pakistan, convened an inter-provincial meeting of the range and livestock experts. On the recommendation of the meeting, the Government of Pakistan constituted a "Sub-Committee on Range-Management" to streamline the institutional arrangements and to determine the guidelines for the formulation of a strategy for range development in the country. The experts reviewed various constraints, including, technical, institutional, social, and economic. They endorsed in principle the comprehensive recommendations of National Range Management Committee, (1973) and urged for their immediate implementation. They also recommended the post of Range-Development Commissioner, along with necessary technical and secretariat staff, to be immediately created with the Food and Agriculture Division of the Ministry of Food, Agriculture and Cooperatives. A National Range Development Board for policy-making, inter-provincial coordination and review of programmes, was suggested under the chairmanship of the Federal Minister for Food, Agriculture and Cooperatives. Similarly, independent organizations under the relevant administrative secretaries of the provincial governments were recommended. They also urged the recognition of range-management as a distinct land-use as well as a separate sector or a sub-sector for budget allocation (GOP, 1983).

In 1991, the Pakistan Forest Policy, recommended stall-feeding of livestock as a replacement for

rangeland grazing. According to their policy, more fodder from the farms and feed from the agro-industrial wastes should be produced and grazing allotments should be created on experimental basis and legislation should be introduced to support range-management agencies.

The Ministry of Environment, Government of Pakistan, drafted a new National Forest Policy in 2002, which has been submitted to the Cabinet for approval. This policy suggests technical and financial assistance of the Federal Government to the Provincial Governments for rehabilitation and conservation of rangelands in different parts of the country.

SUGGESTIONS FOR DEVELOPING RANGE-POLICY

The aforesaid policy directives and recommendations have yet to be implemented. In general, the outlines of the policy enunciated are equally valid today; therefore, those that appear fit in the present rangeland scenario may also be given due consideration while formulating a detailed national rangeland policy. Looking at the current condition of the rangelands, there is an urgent need to develop a comprehensive range-management policy to save this important resource from further loss and degradation. The following suggestions may be helpful in developing an effective and workable range-policy:

a. Legislation is an essential tool for implementing range-management policy. Therefore, legislation is needed to support range-management agencies and their programmes. Development of an efficient system of accountability is an urgent need of the times. Rewarding impartially and generously, the committed and honest workers may bring good changes in the system; the lethargic and corrupt persons should be discouraged. Setting good examples of reward and retribution may bring some desired changes in the attitude of the people concerned with the natural-resource conservation and improvement. Such issues may be covered in detail in range legislation.

b. Participatory range-management approach may be adopted in implementing various range-development projects, because satisfactory progress would not be achieved in natural-resource development work without the active participation of the stake-holding communities. For achieving cooperation of the local people, they must be involved in decision-making process through conducting Rural-appraisal Survey in different rangeland areas of Pakistan. Based on the survey, grazing associations of local people may be formed that could make local-level decisions and share thematic concerns over the rangeland resource-conservation and development activities. They may be assigned resource-protection rights and given some incentives, like credit facilities for livestock-feeding and management activities, a fixed percentage in revenue obtained from rangeland grazing, or else allowing free grazing of their animals may be helpful to develop their interest in resource- conservation process.

c. Training of grazing associations for provision of basic animal-health services may help to improve livestock health and income of the livestock-producer. Promotion of education and awareness-building in nutrition, immunization, disease-control, safe drinking-water, and sanitation may be a part of any programme working for the development and prosperity of the pastoral communities of Pakistan.

d. Alternate-energy sources at subsidized rates may be provided, to the livestock-producer, to save rangelands from further cutting/uprooting of plants.

e. Development of forage reserves of evergreen plants, through installation of tubewells at appropriate sites, will ensure forage supply for the livestock during the winter or drought periods when supply of forage becomes a critical issue.

f. Droughts are a common phenomenon in arid/semi-arid ecosystems. Afzal and others reported a sharp and drastic decline in the livestock population due to the continuous drought that prevailed for four years in Balochistan (Afzal, et. al., 2001). Therefore, necessary incentives to the livestock- producer may be provided against drought losses. The appropriate livestock-insurance mechanism may be developed, or agricultural subsidies may be provided to the livestock-producers to save them from unexpected financial losses.

g. Installation of photo-voltaics and facilities like solar-heated bathrooms and cookers may be introduced in order to reduce the dependence on the use of firewood in the range area.

h. Changes in land-tenure system are desirable to improve interest of the local people in conserving and developing range-resources. Land-ownership system may be transferred from tribal to individual ownership. Privatization of grazing area will help invoke interest of the livestock-producer in improving rangeland area.

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RANGELAND IMPROVEMENT BY COMMUNITY PARTICIPATION IN HIGHLAND BALOCHISTAN: EXPERIENCE OF MANGUCHAR (KALAT) BALOCHISTAN, PAKISTAN

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ABSTRACT

Rangeland productivity in Balochistan is substantially affected due to non-existence of grazing-management practices, low and erratic rainfall distribution, and over-exploitation of natural resources. Most of the rangelands in Balochistan lie within the arid and semi-arid climatic zones. These ranges are degrading very rapidly in terms of biomass production and desirable range-species. Most of the rangelands either belong to individuals or are common rangelands. The owners of the rangelands have the rights and power to stop the grazing by either outsides and/or local pastoralists. However, at present, this system is not in practice in most of the rangeland areas in Balochistan.

The pastoralists are facing a numbers of challenges, the major one being the shortage of feed for livestock. Efforts were directed to improve the community rangelands at Manguchar (Kalat) Balochistan, by understanding the existing range livestock production system, capacity building in co-management concept of rangelands, and involvement of different stakeholders in the planning and implementation of the range management and improvement.

Studies were carried out to determine the potential of biological recovery of heavily grazed rangelands by protecting the area from grazing hazards. Drought and cold-tolerant fodder shrub (Atriplex canescens) plantation was introduced to the community for establishment of forage-reserve blocks for winter grazing. Above-ground dry matter forage-production at community-protected site was recorded as 140 kg/ha, 174 kg/ha, and 190 kg/ha in spring 2005, fall 2005 and spring 2006, respectively. The dry matter forage production in open range area was 40 kg/ha during spring 2006. The community had also collected some native medicinal plants (Achillea santolina, Matricaria lasiocarpa, Ziziphora clinopodiodes) from the protected site. The results indicate that improvement in community rangelands is possible, provided an integrated approach of range livestock-management and improvement is made mandatory, through community participation and collaboration, among different stake-holders.

INTRODUCTION

Pakistan has a total area of 88 million hectare, about 65% of which consists of rangelands. Five different types of range ecological zones (Sub-alpine and temperate, Sub-tropical humid, Sub-tropical sub-humid, Tropical arid and semi-arid deserts plains, and Mediterranean) are found in Pakistan (Khan and Mohammad, 1987). These rangelands are the major feed-source of about 97 million heads of livestock. Precipitation varies from 125 mm to over 1500 mm per annum. About 60 to 70% of monsoon rains are received in the months of July to September, while the winter rains are received from December to February (Khan, 1987) and sometimes the rainy season goes on till April.

Balochistan has a total area of 34 million hectare, of which only 4% (1.47 mha) is under cultivation, while 60% of the cultivated area is rainfed (Khan, 1987). Approximately, 93 % of this area is characterized as rangelands (FAO, 1983). Arid and semi-arid areas are falling within the rainfall zones of 50-200 mm and 250-400 mm, respectively (Kidd, et. al., 1988). Rainfall patterns are unpredictable, due to great fluctuations in its pattern. Like other arid and semi-arid rangelands of the world, Balochistan ranges also provide a diversity of uses, including forage for livestock, wildlife habitat, medicinal plants, water storage and distribution, energy, minerals, fuel-wood, recreational activity, wilderness and natural beauty.

Livestock rearing is the main activity of the inhabitants of Balochistan. Sheep and goats are the main livestock of the province. About 87% of the people in Balochistan, directly or indirectly, derive their livelihood from livestock rearing (Heymell, 1989). About 20 million sheep and goats population have been reported in Balochistan (GOB, 1996). Rangelands are the major feed-source of these animals and approximately 90% of the total feed-requirements of sheep and goats are met from rangelands (FAO, 1983). Overgrazing, drought, erosion, and human-induced stresses have caused severe degradation of rangelands in Balochistan. The degradation of rangelands includes changes in composition of desirable plant-species, a decrease in rangeland diversity and productivity, reduction of perennial plant-cover, and soil erosion (Milton, et. al.,

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1994).

In Balochistan, the mixed grass-shrub steppe is more common than single grass communities. The types of range-vegetation in Balochistan changes from South to North alongwith the rainfall distribution. In the South, shrub species (Haloxylon and Artemisia) while in the North, the perennial grass species (Cymbopogon jwarancusa and Chrysopogon aucheri) are dominant. The fragile ranges of Balochistan are exposed to heavy grazing pressure, aridity, and human disturbances. However, many of these ranges still have potential for improvement by using grazing-management practices, natural recovery of vegetation and artificial re-vegetation in suitable sites, coupled with better water harvesting and conservation practices.

Natural re-vegetation practices, particularly grazing management, may restore vigour and accelerate the spread of desirable species (Vallentine, 1980). However, in arid and semi-arid rangelands, grazing-management alone may not accelerate the succession towards desirable species, due to limited precipitation. Artificial re-vegetation involves the establishment of adapted species, either by seed or transplanting seedlings (Roundy and Call, 1988). Restoration and rehabilitation are the two main procedures for regeneration of a depleted rangeland. Restoration or biological recovery can bring the ecosystem to the pristine situation and rehabilitation or artificial recovery is the artificial establishment of a new type of vegetation, different from the pristine native vegetation (Le Houerou, 2000a). Biological or artificial recovery may include increase in biomass, plant cover, organic matter, soil micro and macro-organisms, better water-intake and turnover, lower evaporation and runoff. Biological recovery may be obtained by protecting the area under consideration from human and livestock intrusion. Artificial recovery is usually achieved by artificial planting of exotic grasses, shrubs, and trees. The purpose of rehabilitation of rangelands may be diversely ranging from forage production, timber production, landscaping, wind breaking, sand-dune fixation, and erosion control (Le Houerou, 2000a).

A major concern of arid and semi-arid ranges is about the progressive reduction of secondary productivity and diversity (West, 1993) and how to manage these changes (Walker, 1993). The management and improvement of arid and semi-arid ranges is always a challenging job. Different theoretical models of rangelands have been developed and a few are also tested in different rangeland ecosystems of the world. However, the arid rangeland ecosystem of Balochistan is very dynamic and major climatic and agricultural changes are occurring in this area. In Balochistan, many range-management projects were carried out with little success. Therefore, there is a need to re-examine the research, policy and management issues in Balochistan for better productivity of rangelands and livestock production. Co-management of rangelands may be a better option as it is a situation in which two or more social actors negotiate, define and guarantee amongst themselves a fair sharing of the management functions, rights and responsibilities for a given territory, areas or set of natural resources. This paper highlights the experiences and lessons learned during the ICIMOD funded project 'Rangeland Improvement by Community Participation in Highland Balochistan', Pakistan.

MATERIALS AND METHODS

Grazing Systems, Pastoralists and Rangeland Survey: A survey was conducted in six villages of Mangucher areas (Mungri, Burdo, Soore, Mahmood Gohram, Purdozai, and Aalikhail) to quantify the distribution of livestock in Mangucher valley throughout the year and establish the importance of the range, to establish the grazing pattern of livestock throughout the year and to identify the local customary law regarding use and management of range.

Recovery Potential of Degraded Rangelands: Five hundred hectares of degraded rangeland at Mangochar (Kalat) was protected with community participation during the month of March 2005. Fifteen permanent transects 25 m long were established in the range area. These transects run parallel to each other at a distance of 20m. Vegetation data during different seasons were recorded to measure changes in above-ground productivity and the rate of recovery as a result of protection from grazing. Above ground biomass production was measured by using 1 x 5 m^2 quadrates randomly placed about 5-10 m away from the permanent transect lines. Plant species inside the 5 m^2 quadrates were clipped at ground-level (destructive sampling). The plant species were separated and their dry weight was recorded. Similarly, biomass production was also estimated from nearby unprotected range area.

Establishment of Fodder Shrub (Atriplex canescens) Blocks: Four thousand seedlings of Atriplex canescens were planted during April and May

2005, in pits, with community participation. The main purpose of this plantation was to develop a forage reserve blocks for winter grazing when most of the native range- species are in dormant stage and livestock suffers from feed-shortage. Plant growth and survival rate and forage production were recorded.

RESULTS AND DISCUSSION

Socio-economic Profile: The average age of the respondent farmers was estimated as about 48 years. They had a mean experience of about 23 years in livestock herding. Crop-production experience in Pastoralists was found to be higher than in the transhumants. Majority of the respondents (89%) did not attend the school and the mean formal education of the respondents was estimated to be below one year of schooling. A significantly higher percentage of the agro-pastoralists attended the school, as compared with that of the pastoralists. The average family size of the respondent's families was estimated as about 13 persons per household, comprising approximately 1 old person (>60 years), 6 adults (>16-60 years) and 6 children (upto 16 years). So the dependency ratio was around 54%. The family size in the tribal set up is large and shows extended family system. In Mangochar, the average distance of various facilities from village/settlement locations ranged from 3 to 22 kilometres.

Natural Capital: The average size of the operational land-holding of agro-pastoralists was estimated to be 13.6 acres. The average livestock herd size of nomad and sedentary was 160 and 43 small ruminants, respectively. Large ruminants average animal-holding was 0.5 for camels and 1.13 cow per household. The agro-pastoralists in Mangucher area were operating farms of significantly smaller size than their counterparts in other districts. In Manguchar, livestock production is well integrated with the availability of water and vegetation. Irrespective of the type of livestock-production system followed (i.e. pastoralist or agro-pastoralist), the livestock herders spend a part of their summer in villages. Apart from grazing in the harvested fields and weedy fallow, the weak animals are given supplemental feeding at home.

Sheep ownership averaged 61 heads per herd, including 1 ram, 49 sheep and 11 young stock. Breeding rams and bucks were found with very few herders. The agro-pastoralist types of livestock farmers were found keeping bigger herds of each type of animals (except camels and goats), but the difference between both categories was non-significant. Sedentary is the dominant grazing system in the area. Very few farmers are transhumant and practice cyclic migration to the low lands in the severe winter for feed, fuel and to get off-farm work opportunity. Feed source of various livestock population is derived from the crop sector and rangelands. The major source of feed for small ruminants is rangeland and weedy fallow areas. The survey results indicated that animal feeds were consisting of two types, i.e. stall feeding and open grazing. Cereal straw was given round the year to fill the belly of animals. Native pasture and weedy fellow was found as a major feed-source.

Rangeland Status: There are two types of private rangelands in Balochistan, according to the property type: common rangelands (Community) and open rangelands (Tribal). Tribes traditionally own common rangelands with customary institutional arrangements for their sustainability and effective managements. Open rangelands, used to be commonly owned, have free access to all whether nomads or local pastoralists and have usually deteriorated. So these rangelands are at risk and are considered as no man's land. The other alarming fact is that rangelands are being leveled for agricultural purposes. The water rights often limit the amount of land farmed and uncultivated land is usually held on a communal basis, recognized as Shamalat. All the communities in the project area have Shamalat, as 3rd category of range, which is near the village/land settlements.

There are tribal norms rather culture, e.g. when any outsiders entered in the area, they offer at least two healthy animals to the community head as token of respect. On the other hand, pastoralists have accepted the leadership and follow the tribal norms, as a member of this community. Mixed response was observed regarding rangeland management; whether open access for outsiders or permission is compulsory. More than 90% of the respondents were of the view that we know the nomads since our forefathers' time, and they do not need formal permission. The nomadic pastoralists used to migrate from highland to lowlands when the winter started, along with their animals and families. They normally start migrating in October and come back in March. The precise time of departure and return of herders depends on weather conditions and occurrence of rains. Normally, they start travelling back to the highland in the end of March. During an interview, it has been observed that since 10-15 years, the nomads have settled and adopted agricultural tenancy as additional source of income and the utilization of

surplus labour force. Now they are permanent members of the society, despite the fact that they are living in their traditional huts. This shift can be linked with the severe drought for the last five to six years.

Livestock marketing system here in Balochistan is a very complex issue due to un-systematic marketing. Distance to market, lack of infrastructure and traders' monopoly are the major hindrances. The livestock marketing channels include local selling to fellow herders, livestock traders or beoparies, butchers and in the livestock markets. A significant number of farmers used more than one marketing channel for selling their animals. Selling of livestock to beoparies or/and butchers was the most frequently used channel. A small proportion of the herders sold their animals through livestock markets. It can be concluded that beoparies or/and butchers constituted the major livestock marketing channels in Balochistan. Relatively high percentage of agro-pastoralists was selling their animals through livestock markets than that of their counterparts.

RECOVERY POTENTIAL OF DEGRADED RANGELANDS

The main range vegetation of the area includes:

Dominant Shrubs:	Haloxylon grifithii, Artemisia species, Peganum harmala, Hertia intermedia
Rare Shrubs:	Astragalus stocksii, Convolvulus leiocalycinus
Annual Grasses:	Poa bulbosa
Perennial grasses:	Saccharum species, Cymbopogon jwarancusa, Chrysopogon aucheri

Peganum harmala and *Hertia intermedia* are species less preferred by small ruminants. Peganum harmala is only grazed in winter season when plants are dry, while only the flowers of Hertia intermedia are grazed by sheep and goats. Perennial grasses were grazed very severely and only the hummocks of grazed plants were existing. During 2005, total rainfall (253 mm) and its distribution was also better. As a result, the overall range productivity and species composition was better. However, during the 2006 monsoon season only 71 mm rainfall was received, resulting in low forage production. Above-ground dry matter forage production at community protected site was recorded 140 kg/ha, 174 kg/ha, and 190 kg/ha in spring 2005, fall 2005 and spring 2006, respectively. The dry matter forage production in open range area was 40 kg/ha during spring 2006. The protection of degraded rangelands of Mangochar showed some recovery of vegetation. Perennial grasses are coming back and shrubs have better growth and had reached up to seed production. The community also had collected some native medicinal plants (Achillea santolina, Matricaria lasiocarpa, Ziziphora clinopodiodes) from the protected site. The protected site has much better species biodiversity, compared to open rangelands. The community also has the opinion that now it has better availability of fuel-wood resources. This site provided a demonstration to other tribes and communities about range-management options and proper utilization of rangeland resources.

Results from this study show that mixed shrub-grassland steppe of Manguchar have potential of biological recovery, if protected from grazing at least two to three years, depending on rainfall distribution. The rate of biological recovery might be slow, as expected in the arid and semiarid climatic zones. The rate of recovery is also related with the rainfall-distribution, rather than total rainfall. Strong vegetation recovery-response has been reported even under desert conditions with mean annual rainfall of 60-80 mm under deep and permeable soils (Le Houerou, 1992a). From Morocco to Iran, the perennial ground cover and primary productivity are enhanced by a factor of 2-5 and in most cases, 3-4 within a few years, either by total or partial protection (Le Houerou, 1992a). In West Asia and North Africa, range exclosures from 11 countries showed that productivity in exclosures enhanced by 2.8 times (average) than the adjacent grazed areas (Le Houerou, 1998). However, very long-term protection may not yield better results, due to accumulation of dead old material (personal observation) that reduced the new fresh growth. Controlled grazing may produce similar or better results than exclosures in some cases (Le Houerou, 2000a). The recruitment rate of grasses may not be achieved within two to three years protection. The changes in species composition are very slow processes in arid and semiarid areas (West et. al., 1984). Limited spring season rainfall (the optimal time of seedling recruitment) in Balochistan is the main factor for low seedling recruitment, even under complete protection from grazing. According to long-term meteorological data-analysis in Balochistan, it is observed that above-normal rainfall amounts that promoted spring seedling emergence, occur with about 10% and less than 10% probability

(Keatinge and Rees, 1988).

ESTABLISHMENT OF POTENTIAL FODDER SHRUB (ATRIPLEX CANESCENS BLOCKS)

Seedling survival-rate was 75% and surviving plants attained average plant height of 90 cm. During Spring 2006, the average dry matter forage production per plant was recorded to be 30 gm, with an equal amount of wood production. The growth of the surviving plants was affected during 2006 due to limited rainfall, particularly during the spring season. The community was also educated about the nursery raising, transplantation, management and utilization of the fodder shrubs.

The biomass and productivity of fourwing saltbush is highly variable, depending upon the ecological condition of the soil and climate, as well as the management applied. Artificial plantations of fourwing saltbush under rainfed conditions can yield 2000-4000 kg dry matter/ha/year in areas with mean annual rainfall of 200-400 mm, under proper management. The most desirable characteristics of fourwing saltbush include its extreme drought and cold tolerance and high-quality browse, especially during summer and autumn months. The crude protein contents in leaves of fourwing saltbush have been reported in the range of 12-15 % during mid winter (Thomson, et. al., 1997). It has been suggested that one acre of fourwing saltbush might provide the supplemental protein requirements for 0.5 to 1 animal unit during a 90-day period (Ueckert, 1985). Like other halophytes, fourwing saltbush has low energy values because of high ash contents. The energy values are reported to cover only maintenance requirements of sheep, if they consume 1.2-1.5 kg DM/d (Le Houerou, 1992b). The digestibility of dry matter and of organic matter has been reported to be around 60% and 50%, respectively (Le Houerou, et. al., 1983). The digestibility of nitrogen has been reported to be around 65%, but the retention of nitrogen is only 55%. Atriplex supplemented with grazing of native ranges resulted in animal weight-gains of around 80 g/h/d (Le Houerou, et. al., 1983). Atriplex forage consumption, in addition to stubble or wheat straw consumption, could lead to a well balanced ration and fulfil the nutritional requirements of animals in a productive grazing system (Le Houerou, et. al., 1991, Mirza, et. al., 2000).

CONCLUSION

Increase in range dry-matter forage production, species biodiversity, and demonstration to the community about range-management options.

The recovery of degraded rangelands is possible by providing two to three years rest from grazing and other human disturbances. The fodder shrubs should be transplanted in early spring for maximum utilization of rainwater and better establishment chances. Most of the pastoralists are unaware about range-management and improvement options. Heavily grazed rangelands of Balochistan have recovery-potential if protected from grazing for three to four years depending upon rainfall distribution. Communities alone cannot bear the re-vegetation cost. Legal, regulatory, and administrative incentives are required. Co-management of rangelands requires long time to gain the confidence of communities and show them some impact on their range and livestock production.

RECOMMENDATIONS

a. ***Rangeland Research:*** The rangelands of Balochistan need an urgent and well-planned programme in management and utilization to halt the degradation process leading towards desertification. The degradation of rangelands is not only caused by overstocking but non-existence of grazing management practices. Experience and research work indicate that in some areas native vegetation recovery is still possible, either by deferred or rotational grazing methods. However, still very limited information is available on the present status of rangelands of Balochistan, like potential range areas, forage productivity, species composition and its contribution to animal diets, digestibility, nutritive value of range-species, growth, and propagation practices. Therefore, there is a need to characterize the rangelands of Balochistan and recommend appropriate management/ improvement work and policy. Monitoring of long-term changes in rangeland health at several representative range-sites should be initiated, to gather information on trends on vegetation dynamics and degradation processes. Drought-tolerant fodder shrubs could make a substantial contribution in feed during the winter season. The research work should be focused on identification of such range germplasm. Plantation of fodder shrubs with cereal inter-cropping should be explored on the farmer fields. The range-ecology research should focus on re-vegetating heavily degraded ranges with native shrubs and re-establishing native perennial grasses on potential

range-sites. Rangelands must be considered as an ecosystem, rather than just grazing lands. Combined efforts of range livestock management should be used, rather than single range management and improvement work. Watershed areas may be explored for both range livestock development and watershed management.

b. ***Rangeland Policy:*** Creation of National Range-Management Committee at federal and provincial levels is recommended for research, advocacy and policy development and its implementation. Research organizations should monitor the rangeland productivity, in different ecological zones, and plan grazing management plans; this should be a part of range management policy.

c. ***Rangeland Development Work:*** Social infrastructure should be improved in remote range areas for improving the livelihood of the pastoralist communities. Some incentives should be provided to the communities for range-management/improvement work. Forage-reserve block establishment on marginal lands, with some Governmental incentives may ensure forage supply in winter or drought years. Supply of high-production drought and cold-tolerant forage fodder crops, on minimum price, should be introduced to complement native rangelands. These pastures may be used during the critical forage-deficit period (winter months) and at the same time may allow some rest to the rangelands. An integrated approach of range-livestock production and dryland crop-production should be adopted to ensure the forage/feed availability by utilizing all the available resources.

Provision and development of stock water may ensure the grazing in some potential range areas that are, at present, not grazed due to non-availability of stock water. Awareness of communities about livestock diseases, control measures and better processing of skin/hides may ensure better marketing of by-products. Rangelands alone cannot meet the nutritional requirements of livestock, therefore, introduction of low-cost supplementary feed may enhance livestock production and productivity. The range management and improvement programme normally lasts two to three years. However, this duration in arid and semi-arid areas is too limited to show any noticeable impact to communities on range-management/improvement. Therefore, a more reasonable time-frame must be allowed for such projects.

d. ***Community Rangelands:*** Land-tenure and ownership of rangelands in Balochistan should be characterized. Awareness programme of communities, on indiscriminate removal of vegetation for fuel wood, should be initiated. Grazing associations at village-level and livestock cooperatives should be formed for community range management and creation of better marketing of livestock. Range-management and improvement work should be conducted on communities' rangelands and their involvement must be ensured in all decision-making and planning processes. In the past, most of the range activities were limited to Government lands. Generally, pastoralists are not willing to reduce their livestock numbers (de-stocking). However, it is possible to raise a lamb crop of marketable size in one season from February-March to October-November, with supplementary feeding and then keep only ewes during the winter season.

e. ***Human Resource Development:*** Lack of trained manpower on rangeland related issues are another major constraint. Therefore, on-the-job training programmes for scientists and field staff should be arranged on different range-related and researchable areas, like: rangeland monitoring; vegetation sampling; use of Geo-informatics for rangeland resource management; latest practices of range-management and improvement in arid and semi-arid areas; and community based research methods, either at National or International level.

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EDIBLE OIL SCENARIO IN PAKISTAN: 1995-2008

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ABSTRACT

Since edible oil is a vital food item, its persistent shortage and, consequently, increasing imports for meeting domestic consumption-needs, has attained almost the second position in the import-bill, the first being petroleum products. Not only the increases in quantity and import-costs, but also the remedial measures suggested to reduce the imports and increase domestic production of oil-seeds have, thus, prompted us to re-visit the situation that exists in the country. The present report, describes in detail the domestic production, imports and processing facilities that have been available from 1994 onwards till 2008.

The unfavourable edible oil position in the country has not changed much since 1994, except that the imports have almost doubled from about one million to two million tonnes, the population has increased from about 130 millions to 160 millions and the local production/availability has shown a slight increase only.

In order to remedy this situation, there should be a clear national plan defining the objective to achieve the goals of both long and short-terms for maintaining the determined percentage of local production of oilseeds. The plan should be drawn up with the stake-holders and its implementation should be entrusted to the provincial governments, with complete cooperation of the Pakistan Agricultural Research Council.

INTRODUCTION

In an earlier report under the same caption (Shafiq, et. al., 1996), the situation regarding local production, imports and domestic consumption of edible oils in Pakistan was studied for a period of 25 years (1970-1994) and it was observed that imports increased from 81 thousand tonnes to 1057 thousand tonnes (1970-1971), while domestic production increased from 199 thousand tonnes to 471 thousand tonnes for the same period. It was further observed that the total consumption increased from 280 thousand tonnes to 1528 thousand tonnes for the same period and consequently, the domestic production (as percentage of consumption) decreased from 71.07 to 30.17 and the imports as percentage of consumption increased from 28.93 to 69.83, during the considered period of time (Shafiq, et. al., 1996).

The most striking fact provided by this study was that the situation in 1993-94 was reversed, as the imports catered for about 70% of the needs compared to the period of 1970-71 when 70% needs were met from the domestic production. In yet another report titled Reflections of the Contributions related to the Edible Oil scenario in Pakistan, the background and the changes have been discussed in detail (Shafiq, 2002).

Since edible oil is a vital food item, its persistent shortage and, consequently, increasing imports for meeting domestic consumption-needs, has attained almost the second position in the import-bill, the first being the petroleum products. Not only the increases in quantity and import-costs, but also the remedial measures suggested from private and public sources to reduce the imports and increase domestic production of oil-seeds have, thus, prompted us to re-visit the situation that exists in the country. The present report therefore, describes the domestic production, imports and processing facilities that have been available from 1994 onwards till 2008. It is hoped that the report will re-emphasize the need to have a plan in place for staggered implementation with a view to attaining a modicum of self-reliance in this essential food-factor over the next few years and, thus, reduce and then completely get rid of dependence on imports. This approach is practicable, as Pakistan is basically an agricultural country and both land and weather circumstances are favourable for attaining this goal by concerted efforts of the private and public sector stake-holders, in the larger interests of the country.

LOCAL PRODUCTION OF EDIBLE OILS: 1998-2008

The major commercial oil-seed crops of Pakistan, as reported earlier, are cotton and rapeseed. However, under various developmental projects, efforts were made over the years to not only increase the area of cultivation for these crops but also to introduce some non-traditional oilseed crops so as to increase their local availability. It is observed that, of the three non-traditional crops comprising soyabean, saflower and sunflower, only the last mentioned has provided encouraging results and is supporting the traditional/commercial crops of cotton seed and rapeseed in broadening the base for local production. It is of interest to state here that the introduction of "double zero" rapeseed (canola types), either free of erucic acid and glucosinolate or have them in insignificant amounts in their seed, have come up

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Table - 1: Local Annual Production of Edible Oils (1998-2008)

Tonnes

	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008
Cotton Seed	360,000	436,791	436,800	432,800	433,000	414,000	449,000	536,000	456,000	478,000	465,000
Rapeseed(+Canola)	114,700	98,065	95,000	85,100	89,000	121,000	137,000	116,000	117,000	128,000	127,000
Sunflower	109,400	77,109	71,000	43,500	79,000	106,000	154,000	205,000	220,000	251,000	250,000
Total	584100	612,145	602,800	561,400	601,000	641,000	740,000	857,000	793,000	857,000	627,500

Source: *Pakistan Economic Survey*

Table - 2: Imports of Edible Oils (1998-2008)

Tonnes

Oil/Year	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008
Crude Palm Oil	-	-	-	-	-	125,581	117,248	141,387	427,412	483,466	502,797
RBD Palm Oil	1,087,596	1,018,961	10,99,702	1,340,065	326,582	199,169	248,568	100,095	15,694	2,299	278,422
RBD Palm Oil	-	-	-	-	879,839	1,047,561	1,053,011	1,361,047	1,301,819	1,146,349	619,034
Soyabean Oil	258,950	268,081	166,025	187,601	80,988	126,000	52,350	19,999	20,121	96,164	20,969
Other Edible Oils	4,325	6,999	44,300	42,625	-	2,657	1,106	-	-	-	-
Total	1,350,871	1,357,041	1,310,027	1,570,291	1,287,409	1,500,968	1,472,283	1,622,528	1,765,046	1,728,278	1,421,222

Source: *Malaysian Palm Oil Council (MPOC)*

nicely in the country. The data provided in the Table-1 makes the present scenario rather clear. It is encouraging to note that the local production of rape seed is now also composed of about 50% share contributed by canola types. The canola seeds are also imported and oil is extracted from them to enhance the availability of oil. Similarly, the contributions from sunflower seeds are also significantly improving, as seen from the figures in Table-1(1998-2008), which can be compared to those of the previous decade (1988-1997).

Inspite of this increase, the situation has not taken a turn for the better because of the population increase, low yields and no satisfactory increase in the areas under cultivation of these annual crops, which also have to compete with the other seasonal food grain crops. Secondly, the domestic consumption has been increasing steadily because of the awareness and desire for better quality of life, particularly, in the urban areas where almost 40% of the country's population resides. The rural population, however, still uses the animal fat (butter oil) which is being produced and consumed by the agricultural community. The production of butter oil is probably not more than about 0.35 million tonnes per annum. Exact figures for this commodity are not available as the dairy farming is not so organized in the country. The local production of edible oils is, thus, still not enough to meet more than 30% of the indigenous requirements of this important food item and, consequently, the country is meeting its needs through massive imports.

IMPORTS OF EDIBLE OIL

It has been estimated that the country needs about 2.6-3.0 million tonnes of edible oils and fats for its ever-increasing population that now stands at a figure of 160 millions. These needs are met by importing about 1.8 million tonnes of edible oil from abroad and producing about 0.7 million tonnes, indigenously. The annual import and production figures for the years 1998-2008 are provided in Table-2. When compared with the previous report's figures, it becomes evident that the imports have increased while the local production has virtually not shown any visible increase. The locally produced oils are mainly extracted from cotton seed and rapeseed (including canola and sunflower seeds), while the imported oils are as usual palm oil (and its fractions) and soyabean oils. In addition to Refined Bleached and Deodourized (RBD) palm oil, the oil processors have now also started importing crude palm oil (since 2003) and RBD palm-olean (since 2002) in various amounts. In this scenario, it is observed that the import of soyabean oil is decreasing from 0.26 million tonnes to about 0.02 million tonnes from 1998 to 2008, respectively. On the other hand, the import of palm oil and its products (for edible purposes) has shown a steady increase during 1998 to 2007 from about 1.1 million tonnes to 1.8 million tonnes. In the breakup, the crude palm oils share is 28%, RBD palm oils share is 0.1%, RBD palm-olean share is 66.3% and that of soyabean oil is 5.5%. The most striking development during the period under study is, thus, the virtual replacement of RBD palm oil by palm-olean and a significant addition of crude palm oil (28%) for the use in the refineries that have been set up in the country. By physical refining, these facilities provide RBD palm oil as such for a replacement and/or a competitive product to vanaspati (hydrogenated vegetable oil) which is still largely used as a cooking medium of choice in Pakistan.

THE EDIBLE OIL AND FAT INDUSTRY

A recent report described the current scenario regarding edible oils, particularly emphasizing the hydrogenated oil industry in the country. This information is reproduced below for the general benefit of the public at large, but the changes that have occurred during the past six years are described first.

As a consequence of the Government's policy of denationalization, whole of the vegetable oil hydrogenation industry now exists in the private sector and an organization called Pakistan Vanaspati Manufacturers Association (PVMA), located in Islamabad, looks after the affairs of the member units registered with the PVMA number 92. The concentration of the registered units throughout the country is: North, 21 units; Central: 38 units and South 33 units, and their installed capacity is estimated to be over 2.5 million tonnes per annum.

Another organization called Pakistan Edible Oil Refineries Association (PEORA), which has started functioning, deals exclusively with edible-oil refining and has the membership and installed capacity (per day) as given in Box-1.

Currently, the national demand for 160 million people is estimated to be around 3 million tonnes and the total installed capacity for producing hydrogenated vegetable oils (vanaspati) and refined edible oils is over 3.5 millions tonnes, enough to cater for the indigenous needs.

Box - 1: Member Refining Units of PEORA

Unit	Group	Installed Capacity (Tonnes/Day)
Evian Fats and Oils	Allana Group	800
Habib Oil Mills	Habib Oil Mills	500
M.H Oil Mills	-	200
Faisalabad Oil Refinery	Madina Group	500
Mapak Edible Oils	Westbury, Mapak, KLK	800
Eva Oil Refinery	Shujabad Agro	150
Sufi Oil Refinery	Sufi Group	300
Paracha Oil Refinery	Paracha Textiles	500

Source: *Malaysian Palm Oil Council*

LITERATURE REVIEW

A number of reports (both survey and research) indicate that a large percentage of population prefers hydrogenated vegetable oils as a frying medium for preparing traditional foods. This trend has emerged and strengthened because of many factors, including decreased local production of oil seeds, increasing population growth rate, non-expansion of dairy-farming industry and heavy dependence on imported vegetable oils.

In spite of this, the consumption of edible oils has been increasing (at over 10% per annum) and, consequently, the hydrogenation industry has expanded during the past two decades to meet the popular local demands. It is, thus, seen that during the 70's, when this industry was nationalized, there were about 30 units with installed capacity of less than 0.25 million tonnes, whereas in the 90's Pakistan has about 140 units with a capacity of over 2.0 million tonnes per year. The increase in the size of the industry's units for the past 20 years alone (1974-1994) is almost 4.7 times, while their processing capacity has increased by a factor of (about) 8 in the same period. It has been estimated that the functional hydrogenation units are spread all over the country and their largest concentration is in Punjab (70) followed by Sindh (35), NWPF (15), Baluchistan (2) and Azad Kashmir (1). The Federal Capital, Islamabad, has 8 units in its territorial limits. This spread in the country, including the Federal Capital, is well understood as it caters to the needs of population density and because of the incentives provided by the government to create industrial estates at selected places. The effect of these incentives is well-established from the fact that the conglomeration of the units is at Bahawalpur, Faisalabad, Hattar, Islamabad, Karachi, Lahore, Multan and Peshawar-the cities where industrial estates have been established, as planned. Many entrepreneurs have been offered various incentives to establish industry. The majority of the units produce hydrogenated product "Vanaspati", while the same are geared for producing and marketing the cooking oils as such. Both the "Vanaspati" and "Cooking Oil" products are not necessarily produced from any single oil, but are largely based on a blend of oils that is easily and economically available during the manufacturing period of the year. The major oils that go into production of the local products are: local cottonseed oil, rapeseed (canola), sunflower and imported soyabean and palm oils.

The expansion and growth of the hydrogenation industry in Pakistan suggests that the local consumers of the processed product (vanaspati) prefer the semi-solid fat, which resembles "Ghee" (butter oil) in appreance, as a frying medium. This argument is supported by another observation that the production, marketing and consumption of cooking oils is hardly 10% of the total turnover of the industry, and is limited to the big cities only. Vanaspati is marketed in packings of various capacities, ranging from 1kg to 16kg, both in cans, as well as plastic containers and bags. The industrial product produced by oil-processing units is marketed under different trade names (over 50), although it may have been manufactured from a similar blend of oils. Because of the similarities of the specifications of the imported RBD palm oil to those of the Vanaspati, the former is also being packed and marketed as such, without hydrogenation. This practice irritates the processing industry but is viewed differently by the educated consumers, as it provides a product that is naturally occurring and is free from trans fatty acids that are always present in minor amounts in the hydrogenated product. Theoretically, catalytic hydrogenation is supposed to provide an allcis-product, but practical evidence is there to suggest that during hydrogenation some trans-addition of hydrogen also occurs and, consequently,

Table - 3: Retail Prices of 1kg Vegetable Ghee and 1 Ltr Cooking Oil During the Years 1990-91 to 2007-08

Year	Veg. Ghee	Cooking Oil	Year	Veg. Ghee	Cooking Oil
	Rs./Kg	Rs./Ltr		Rs./Kg	Rs./Ltr
1990-91	19.63	23.80	1999-2000	65.98	66.77
1991-92	20.70	25.13	2000-01	61.37	62.26
1992-93	24.83	28.30	2001-02	67.70	68.39
1993-94	31.18	34.89	2002-03	78.71	79.87
1994-95	41.85	46.73	2003-04	80.11	81.59
1995-96	43.93	49.00	2004-05	81.66	82.00
1996-97	47.62	53.86	2005-06	81.45	81.76
1997-98	52.79	59.58	2006-07	89.62	89.79
1998-99	63.18	67.31	2007-08	119.76	120.77

Source: *Pakistan Economic Survey, 2001-02 and 2007-08, Ministry of Finance, Government of Pakistan*

the end- product has certain taints of trans-fatty acids in it. However, the produced and marketed product is claimed to conform to the Pakistan Standard Specifications No. 221 of 1962 issued by Pakistan Standards Institution, Karachi, and is utilized by the consumers of the country.

RETAIL MARKET PRICES

In view of inadequate local production of vegetable oils, the retail market price of the hydrogenated and un-hydrogenated vegetable oil is supposed to be dependent on the global prices of the vegetable oils that are imported in the country for meeting the local demands. Although the changing global prices of not only the vegetable oils, but also those of the crude oil (petroleum/ hydrocarbon, as it effects the transport expenses) are always linked to the increases/ decreases of the locally produced hydrogenated and un-hydrogenated products' prices for the consumer. It has been observed that the local manufacturers do not always pass on the benefits to the consumer, as exemplified by the prices for (16 kg tin) vanaspati and cooking oil (Dawn, 2009) for December 2008 and January 2009, as given in the footnote in the form of Box-2(a) and Box-2(b).

A comparison of current prices, with those from the selected previous years, is provided above as it makes reading interesting because cooking oil was sold at a higher price (about 4 times in 1995) than vanaspati in 1986 (at almost equal price in 1995) and, after about twenty years, is again marketed at a price higher than the vanaspati in 1986. However, an idea of variations in prices of 1kg packs of vanaspati and cooking oil over 2 decades can be had from the data (Table-3).

In conclusion, it is summarized that the edible oil position in the country has not changed much since 1994, except that the imports of edible oil have almost doubled from about one million to two million tonnes, the population has increased from about 130 millions to 160 millions and the local production/availability has shown only slight increase from 0.584 to 0.627 million tonnes. Consequently, the dependence on imports now stands at about 70%, while the local production contributes only 30% of the current consumption demands, as the measures suggested in various earlier reports, referred to in the text here, have not been taken to improve the situation. It is reiterated that there should be a clear national plan defining the objective to achieve the goals of both long and short terms for the determined percentage of local

Footnote:

Box - 2(a): Retail Prices of 16kg Vanaspati and Cooking Oil

Date	Vanaspati Price	Cooking Oil Price
December 2008	Rs. 1370.00	Rs. 1550.00
1st January 2009	Rs. 1510.00	Rs. 1650.00
6th January 2009	Rs. 1620.00	Rs. 1740.00

Box - 2(b): Comparison of Escalating Prices of Vanaspati and Cooking Oil (5kg packs)

Year	Vanaspati Price	Cooking Oil Price
1968	Rs. 67.45	Rs. 60.00
1995	Rs. 243.00	Rs. 242.00
2009	Rs. 640.00	Rs. 685.00

production of oil seeds. The plan should be drawn by the stake-holders and its implementation should be entrusted to the provincial governments, with complete cooperation of the Pakistan Agricultural Research Council. This could provide a path towards a balanced oil-seeds scenario in Pakistan.

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HIGHER EDUCATION COMMISSION – Analysis of Human Resource Development (HRD) Programmes

*Abdul Qayyum Kazi**

ABSTRACT

This article takes stock of the activities undertaken in the education sector of Pakistan with a special emphasis on higher education. Pertinent recommendations are proposed for the improvement of this sector on the basis of the analysis of the existing human resource development programmes.

INTRODUCTION

The University Grants Commission (1997), now the Higher Education Commission (HEC) in the document "Vision 2010: Higher Education in Pakistan" outlined the issues of higher education in Pakistan and spelled out the remedial measures that need to be taken for making it effective; it observed that "Pakistan after 50 years of its existence does not find itself in an enviable position (HEC, 1997). Out of 175 countries of the world, Pakistan's ranking order in terms of human development profile comes to 139 (UNDP, 1997)". Seen in the perspective of human-development indicators viz providing basic education, basic health-care, safe drinking water, adequate nutrition, energy consumption and gender equality, Pakistan presents a bleak picture. As per the Human Development Report (2005) Pakistan is ranked at number 135 in comparison to its position of 144 in 2004 and 138 in 2003 indicating negligible improvement as far as the human development indicators are concerned.

The recent Human Development Reports, published by UNDP, indicate that there is no chance of achieving the eight Millennium Development Goals, relating to issues of primary education, poverty, sexual discrimination, hunger, child mortality, maternal health, environment and diseases, by 2015. The progress is too slow to achieve the targets. Besides lack of required financial inputs, political will, infrastructure and policy decisions, the main hurdle is the lack of qualified and trained manpower to work in the field of human-resource development (HRD) with commitment and perseverance in achieving these goals by the year 2015.

Today, the S&T sector in Muslim countries is suffering from acute shortage of talented and well-trained scientists, engineers and technicians which is impeding their socio-economic growth. This inadequacy must be overcome immediately, if the benefits from the investments in scientific research are to be reaped fully. Any HRD programme should be arranged in such a way that the present and future requirements and needs of universities, R&D institutions and industries as well as the needs of the community are met, and a cushion is provided for mitigating the brain drain–the flight of talented persons to the already advanced and rich countries. There is an urgent need to increase the quality and quantity of science education in schools, vocational centres, colleges and universities.

The production of competitive and quality products for matching the standards of the international market, the growing demand of IT industry; reducing the challenges of poverty and malnutrition; strategizing to abate and prevent pollution and diseases; sustainable development and other related issues point to the need for launching a continuous programme for the development of quality manpower in Pakistan.

The 111 universities and degree-awarding institutions (DAIs) of Pakistan are producing a very few PhDs annually and that too of low quality. Their researches do not result in creating new knowledge or techniques and providing support to industry in enhancing the quality of their end-products. For our very existence as an independent nation and for self-reliance and development, it is imperative that our universities should rapidly develop a strong research capability and launch vigorous programmes at PhD and for post-doctoral levels. Now, there is no dearth of funds and scholarships, provided the right approach is followed.

In the last 10 to 15 years, appreciable funds have been provided to the universities for improving the quality of higher education, but the effort is marred by low output of PhDs and publications of quality research papers in international journals of repute.

From the earlier studies conducted by Qurashi & Jafar (1992) and Kazi (2002), it was concluded that there has been an unfortunate failure to build-up productive research groups in universities and to induct qualified and trained manpower in industry and other economic sectors.

THE HIGHER EDUCATION COMMISSION OF PAKISTAN

Universities are fountains of knowledge, education, research and technological development, and are considered as potent agents of development and nation-building. In Pakistan, however, they have been

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Table - 1: Number of Students Enrolled over the Years (by Sector and Level of Degree)

Sector	Year	Bachelors	Masters	MPhil	PhD	Post Grad. Diploma	Total
Public Sector	2001-02	156,141	66,675	3,683	3,061	2,841	232,401
	2002-03	186,602	78,709	4,462	4,045	2,666	276,484
	2003-04	252,841	92,613	6,802	6,277	3,595	362,128
Private Sector	2001-02	30,340	11,854	188	63	1,428	43,873
	2002-03	37,688	15,815	380	93	1,285	55,261
	2003-04	42,871	16,054	652	195	1,336	61,108
Total	2001-02	186,481	78,529	3,871	3,124	4,269	276,274
	2002-03	224,290	94,524	4,842	4,138	3,951	331,745
	2003-04	295,712	108,667	7,454	6,472	4,931	423,236

concentrating on imparting education only and that too on a limited scale. The Higher Education Commission of Pakistan was established on September 11, 2002, under the Presidential Ordinance, replacing the University Grants Commission that had been operating since 1974.

HEC was set up to remove the existing deficiencies and facilitate gradual development of degree-granting universities and institutions (public and private) into world-class centres of education, research and development. HEC launched the Medium-term Development Framework (2005-10) with the strategic aims of faculty development; improving the access to higher education; promoting excellence in learning and research; and its relevance to national needs; as well as building skills for leadership, governance and management (HEC, 2005). The implementation of dozens of programmes is already underway fruition, which need critical analysis and evaluation today. This article briefly reviews the HRD programmes launched by HEC during the last seven years. Though it may be early, but actions are required to keep the situation favourable where billions of rupees are at stake.

According to HEC's Statistical Booklet on Higher Education in Pakistan (2005), there were 111 universities and degree-awarding institutions, 57 in public sector and 54 in private sector (HEC, 2005). Details are given below:

Sector	Universities	Degree-awarding Institutions
Public	49 (4 F)	08 (1 F)
Private	36 (1 F)	18 (0 F)
Total	85 (5 F)	26 (I F)

[Note: F = institutions for Females]

HRD PROGRAMMES

HEC developed programmes to improve the quality of higher education through: (i) faculty development; (ii) improving access to institutions of higher education; (iii) promoting excellence in learning and research; and (iv) focusing on education relevant to the economy and development. With the introduction of various reforms/programmes, there has been a significant increase in the enrollment of students in different levels of education, particularly MPhil from 3,871 to 7,454 and at PhD level from 3,142 to 6,142 between the years 2001-02 and 2003-04, respectively.

This increase is observed to be more in the public-sector educational institutions, mainly due to the introduction of post-graduate scholarship

Table - 2: Numbers of Degree and Post-Graduate Students produced, by Level of Degree, during the period 2001-04

Level of Degree	2001-02			2002-03			2003-04		
	Male	Female	Total	Male	Female	Total	Male	Female	Total
Bachelors	31,714	25,535	57,249	37,243	33,372	70,615	40,350	41,714	82,064
Masters	19,178	12,305	31,483	19,879	13,729	33,608	18,928	13,105	32,033
M.Phil.	393	284	677	470	363	833	516	343	859
Ph.D.	155	72	227	206	84	290	216	78	294
PGD	1,332	565	1,897	1,534	619	2,153	1,789	1,017	2,806
Total	52,772	38,761	91,533	59,332	48,167	107,499	61,799	56,257	118,056

Table - 3: Full-time Faculty Members, Classified by their Highest Qualification, during 2003-04.

Sector	Bachelors	Masters	Masters (H)	M. Phil	PhD	Total
Distance Learning	9	110	0	22	41	182
Public	1,059	4,525	1,319	1,019	2,549	10,471
Private	1,151	1,480	508	284	540	3,963
Overall	2,219	6,115	1,827	1,325	3,130	14,616

programmes. However, the output was rather low, viz. 859 for MPhil and 294 for PhD in that period, albeit it takes longer time to earn these qualifications (Tables 1 and 2). This needs investigation as to whether, inspite of the apparent continuous increase in the input of post-graduate programmes, the low output is due to (i) non-existence of appropriate research facilities, or (ii) low availability of researchers to guide the students for research work and dissertation. The number of students enrolled at various levels are given in Table-1, while the degree-wise numbers of male/female students are given in Table-2.

DATA FOR 2001 TO 2004 AND ANALYSIS

Currently, about 25% of the faculty-members hold PhD degrees and less than 25% of the total faculty is engaged in research. This is quite low as compared to international standards. Interestingly, there were only 14,616 full-time faculty members in 2003-04 (22,182 part-time teachers). In public and private-sector universities and DAIs, 3,130 teachers have PhD degree, while 1,325 have MPhil degree (see Table-3). The number of required qualified teachers is quite low, as compared to the other regional educational institutions even.

EXPENDITURE

The total expenditure for all the universities was found to be Rs. 19.708 billion for 2003-04, with a total income generated upto Rs. 11,300 billion (Table-4). The main portion of expenditure goes to salaries of the faculty and the rest of the establishment. The funds provided to the public-sector institutions have increased considerably, i.e., from Rs. 3,802 billion in 2001-02 to Rs. 14,319 billion in 2001-04. Some exercise needs to be done to quantify the positive effects of the enhanced contribution.

Apparently, what is missing in HEC's HRD programmes, in the context of the present situation and natural endowment, is the establishment of strong research groups and national research laboratories to tackle problems of immediate applicability that aims at research results of industrial utilization, especially in areas of renewable energy, biotechnology, nanotechnology and natural products. The greater emphasis should, of course, be laid on post-graduate teaching and research matching international standards. Japan and Singapore are already following these procedures to meet the shortages of skilled labour.

COMPARISON WITH THE EXAMPLE OF SINGAPORE

With the fall/non-profitability margin in the semi-conductor industry in early 2000, which was the basis of economic success in Singapore, it developed plans to move up the value-chain through focus on high value-added industry in areas of biomedical sciences, nanotechnology and energy. The government adopted a two-core plan viz. (a) attracting highly qualified research scientists to work in Singapore, through establishing state-of-the-art research laboratories, and (b) focusing on graduate-education programme to supply highly-skilled scientists and engineers for R&D-oriented industry. Since 2000, Singapore has pumped more than US$ 2 billion into

Table - 4: Total Budget, Expenditure on Research and Library from Recurring Budget, Recurring & Non-Recurring Expenditure and Income Generated through Own Sources by Public and Private Sector during 2003-04 (in Million Rs.)

Sector	Total Budget	Research Expenditure*	Library Expenditure*	Non-Development Expenditure*	Development Expenditure*	Income From Own Sources*
Public	13,356.032	202.078	139.454	11,312.062	1,568.248	5,801.324
Private	6,352.254	159.389	106.748	4,875.878	1,098.511	5,574.359
Overall	19,708.286	361.467	246.202	16,187.940	2,666.759	11,375.683

* = Excluding the amount of projects.

developing the bio-medical research industry alone, and over a billion dollars for the development of qualified manpower. Carefully selected intelligent students from Singapore and its selected neighbouring countries (China, Hong Kong, India, South Korea and Taiwan) are awarded full scholarships leading to PhD degrees in selected fields. The foreign scholars are offered Singaporean citizenship and work-contracts valid for upto five years after obtaining PhD degrees. Research laboratories manned by research scientists have accelerated research activities within the country. This is evident from the rise in the number of registered patents obtained in Singapore, from 800 in 2000 to 2,100 in 2006. And the graduate programme is aiming at getting 1,000 PhD level researchers by the year 2015.

In the words of Dr. Philip Yeo, Special Advisor for Economic Development, "The economy of Singapore sequentially passed through the phases of being labour-intensive, skill-intensive, capital-intensive and technology-intensive. The last phase, it is passing through, is knowledge-intensive, which translates into creating new products and services" (Gulf News, 2008). A small country like Singapore making huge investments in the development of human resources and supporting S&T infrastructure, is possibly the most shining example for Pakistan to take lead from, especially for its ever-expanding infrastructure of higher education institutions.

PURPOSE OF HIGHER EDUCATION

The purpose of higher education should be to develop the right attitude, the ability to analyse, interpret and communicate ideas. A PhD degree holder knows almost everything about one specific thing, but requires training to develop an analytical frame of mind not to withstand pressure to conduct research independently. Higher education institutions can be made more productive by establishing congenial academic environment, having well equipped laboratories, qualified teachers, and by providing appropriate funding and library facilities for research. Pakistani universities need to follow a similar pattern. Mere doling out money by the Higher Education Commission (HEC) to a large number of universities is really not going to benefit research nor assist in producing quality manpower.

The standard of graduate education needs drastic improvement in order to address issues such as, low quality education, poor examination procedures and curricula development, plagiarism, as well as remove quota system in the federal universities. The higher education should aim to cultivate perseverance, commitment and full-time involvement for research.

All the 111 universities and degree-awarding institutions, recognized by the Higher Education Commission, collectively published mere 1,636 papers in the year 2006. The funding for higher education is 0.5% of GDP in the budget of 2.4% for all forms of education. Not a single Pakistani university has come even close to being included in the chart of 200 international universities. With the exception of HEJ Research Institute of Chemistry (now a part of ICCBS), Karachi, none of our higher education institutions attract foreign scientists/scholars for research towards PhD or post-doctoral training.

The minimum qualification required for teaching and training post-graduate students should be a PhD and that their research papers should be published in scientific journals of repute. The teachers must have acumen to judge the capability of research in a student before the latter could initiate the research-project leading towards MPhil/PhD. The research professors should be allowed to supervise only 3 to 4 students at a time.

The scholarship programmes for M.Sc., MPhil and PhD within the local universities and selected universities abroad, should be based on a regular and comprehensive survey to ascertain the present and future requirements of S&T manpower in universities, and agriculture, industry, health and communication sectors, covering the next 10 years. Monitoring the academic performance and processing of their candidature for employment on completion of studies, should be given a high priority.

Furthermore, the components of higher education should include formation of viable research groups, so as to overcome isolation of individual researchers and to initiate multi-disciplinary approach in addressing issues of national priority (Qurashi and Kazi, 1997).

The development of higher education is correlated with economic development and contributes to the increase in labour productivity and higher economic growth. This is evident from the industrial strides made by USA – the most industrialized country of the world – and India – the newly industrialized country – both having the largest numbers of technical manpower. Considering this position, it is urged that the bulk of applied research should be conducted for and within industry. It is essential to develop strong linkages

between university, R&D institutes and industry so that research projects for M.Phil and PhD could be conducted in collaboration with industrial entrepreneurs.

With the introduction of industries based on information-technology, biotechnology, renewable energy and communication systems, there is a growing requirement for highly qualified and trained manpower to meet their specific needs and to retain workers through attractive salary package, so as to retain their services in the local environment. Even to accelerate the process of industrialization to compete globally, a large input in the form of HRD is essential to maintain quality standards in the products and to conduct R&D activity relevant to a specific area. What is being done by the Higher Education Commission, is just the beginning and needs to be reviewed and strengthened.

PROJECT TO EXAMINE VARIOUS HRD PROGRAMMES

Considering the data presented above and the preliminary analysis, it is recommended that a project be launched to critically examine the HRD programmes. An external agency should undertake formulation and implementation of such a survey project. The objective of the proposed study/survey is to collect factual information from 1200 departments of 111 universities and DAIs, with regard to: (a) the development of manpower needed; (b) response of individual departments regarding various programmes/projects introduced by HEC; (c) their impact on faculty development and approach to research work; and (d) evaluation, viz introduction of information technology and its benefits and hurdles, which are the possible avenues for improvement in working environment and future prospects.

In brief, the following actions are proposed:

a. To assess the actual requirements of manpower (in quantitative and qualitative terms) in the higher education sector. The said requirement should be assessed from various perspectives, including level of education, disciplines and technical competence of faculty to carry out research, etc;

b. To evaluate the extent to which the faculty-development programmes have achieved success in improving education-cum-research capacity, viz:

   i) Whether the services of scholars and trained faculty are properly utilized;
   ii) If not, what are the constraints for a proper utilization of their expertise;
   iii) How can the HRD programmes be improved in the present educational system.

c. To factually determine the impact of reforms by HEC on the educational system presently operative;

d. To assess the impact of facilities provided to and obstacles faced by individual department pursuing research-programmes;

e. Determine to what extent I.T knowledge/skill is utilized in the educational system and research programmes, and asses what other facilities are required;

f. Formulate recommendations to improve access to higher education and to turn the R&D institutions into world-class centres of excellence.

This study should be conducted in all the departments of science, engineering, technology and arts, as well as social and environmental sciences. An expert-committee should determine the sample-size, design and develop survey-questionnaire(s), train enumerators, check data-collection on the spot and supervise compilation and preparation of survey report. The study could be completed in a duration of 12 months and would approximately cost around one million rupees.

BENEFITS OF THE PROJECT

The main beneficiary of this study would be the Higher Education Commission, which will get an independent assessment of the existing situation. On that basis, HEC could modify its approach, chalk out future line-of-action and plan new projects for effective development of high-quality manpower by enhancing caliber of faculty and providing better facilities and equipment to the universities and departments of DAIs, particularly those located in the remote areas. Recognizing that establishing world-class centres in the education sector is quite a slow process, it is vital to have enough number of researchers to carry out developmental programmes and to create effective linkages with other centres around the world. Investment in education is the most profitable venture for nations and individuals and, therefore, HEC should lead the nation more effectively in this endeavour.

Creation of new knowledge nurtures a knowledge-based economy, irrespective of whether the country is devoid of, or endowed with, natural resources. However, the aim should be to utilize this knowledge for the good of mankind and for the good of the country.

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SOCIAL ROLE OF LABOUR UNIONS

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ABSTRACT

According to the definition of labour unions, they have always been attributed with securing financial and non-financial benefits for their members through collective bargaining. In this article, those aspects of labour unions have been researched, which are beyond collective bargaining, through literature in the world and through actual research in Pakistan. Four persons were also interviewed. It is found that unions have also been playing various kinds of social role, beyond collective bargaining for workers and society in: public health, alleviation of poverty, and providing training and educational services to workers. Details of some of these activities in Pakistan are given.

Key Words: *Labour unions, public health, poverty alleviation, training, workers' rights*

INTRODUCTION

According to 'World Labour Report 1997-1998' of ILO (1998), the Australian Bureau of Statistics has defined union as: *"An organization, consisting predominantly of employees, the principal activities of which include the negotiation of pay and conditions of employment for its members"*.

Buchmueller, et. al., (1999) stated that the role of US trade unions, in obtaining health and welfare benefits for their members, dates to the 18th century. According to Munts (1967), earlier union organizations were established for the provision of health and welfare benefits and, later on, they became engaged in bargaining over wages with employers. According to Knowles and Eade (n.d.) the core business of labour unions is to organize and press for fair terms and conditions of work, negotiate on behalf of the work force, provide services for members, bring them into the network, and mobilize them.

So trade unions are considered as organizations mainly struggling to secure benefits for their members through collective bargaining such as financial gains like raise in wages, bonuses, various allowances, insurance benefits, overtime payment as well as non-financial benefits, such as job security, comfortable work-place, recreational facilities and reducing fear of the employer. But several studies have shown that unions also have mandate beyond collective bargaining, such as in environment, energy-management, politics and law making, public health, productivity and efficiency improvement, in addition to role in poverty-alleviation and disasters like earthquakes. Participants of the Conference on Sustainable Development (CSD, 2001) admitted that trade unions have taken an active role in other international fora on issues of sustainable development, including: the Organization for Economic Cooperation and Development (OECD), European Union (EU), Food and Agricultural Organization (FAO), World Health Organization (WHO), World Trade Organization (WTO), International Labour Organization (ILO), and the United Nations Environment Programme (UNEP). Thus, unions want to cooperate with local and national governments, other major groups, and international agencies to bring about patterns of decision-making that are consistent with the goals of sustainable development.

HYPOTHESES

H_0: Unions are socially dull bodies, exerting efforts only for seeking benefits for their members.

H_1: Unions are not socially dull bodies, and exert efforts for social welfare, besides seeking benefits for their members.

RESEARCH METHODOLOGY

Focus of this research is to determine the social efforts of trade unions, particularly in Pakistan. Therefore, this research article has been developed on descriptive secondary information about labour unions in alleviation of poverty, public health and safety, for education and awareness-building throughout the world obtained from research literature. The research based on actual descriptive-cum-numeric data about Pakistani unions and Europe-based unions working directly or in collaboration with Pakistani unions, for welfare and betterment of workers and society in Pakistan. This is a descriptive research and readers like unionists and workers who are not familiar with quantitative methods can also read it.

LITERATURE REVIEW

Role for Public-Health and Sustainable Development

According to CSD (2001), the tradition of union-management partnerships for occupational health and safety is being expanded to include sustainable

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development. These "partnerships" imply that employers and workers share an interest in the overall state of environment, and in so far as they are based on trust, equity and transparency, can be powerful motivators for change. Occupational health and safety toolkits are being developed to guide health and safety activists through identification/analysis of and in response to workplace-problems, these are now being 'repackaged' to accommodate environmental concerns or activities. A workplace-culture of occupational health and safety is now being incorporated into a workplace culture of sustainable development, as unions undertake campaigns that encourage workers to see themselves also as 'environmental citizens'.

UNO admitted during "World Summit on Sustainable Development" WSSD (2002) that trade unions of the world have formulated a position on sustainable development, based on research and interaction with members and employers. This position is distinguished by a clear focus on the Social Dimension and, in particular, on quality employment as the key to poverty eradication and other sustainable development priorities. According to the discussants of World Summit on Sustainable Development (WSSD), the Japan International Labour Foundation (JILAF) has sponsored health and safety training-programmes for thousands of workers, by training trainers in Bangladesh, Japan, Mongolia, Pakistan, and the Philippines. Italian unions participated in multi-party agreement to protect Mediterranean Sea by extending safety measures on ships carrying dangerous cargoes.

UNO underlined the fact in WSSD held in 2002 that since 1992, AIDS/HIV has emerged as one of the most pressing work-place issues of our time, with 23 million working people suffering from this disease (17.5 million in 43 African countries alone). According to WSSD the ICFTU (International Confederation of Free Trade Unions, present ITUC) African Regional Organization (AFRO) has launched a five-year plan on AIDS, focusing on workers in road and maritime transport, mining, agriculture, commerce and hotel sectors in sub-Saharan Africa. Public Services International (PSI) and International Transport Workers' Federation (ITF) have also launched projects, in the belief that trade unions can ensure more sensitive treatment of workers facing this disease.

ILO (2005) reported that trade unions around the world have made HIV/AIDS prevention and care a priority area of their work, by using their expertise in dealing with occupational health and safety hazards, as well as environmental concerns to fight the pandemic. The value addition of trade unions in the fight against HIV/AIDS is that they have closer links to their members, are trusted by them, and can, therefore, easily relate to those who are infected. Trade unions are also developing partnerships with employers, as is spelt out in the ICFTU-International Organization of Employers (IOE) statement entitled "Fighting HIV/AIDS together: A Programme for future engagement". The Ghana Employers Association has been running its HIV/AIDS project with the Ghana Trades Union Congress since mid-2001. In the domain of car industry in South Africa, Ford has established a well-functioning partnership for HIV/AIDS with the Congress of South African Trade Unions (COSATU), affiliated with National Union of Metal and Allied Workers of South Africa, through the involvement of shop stewards. One particular area where the voice of trade union has been heard more and more is the campaign for high quality, cheap and affordable life-saving drugs. Pressure has been put on governments to ensure that the WTO Agreement on Trade-Related Aspects of Intellectual Property Rights (TRIPS) and intellectual provisions in regional and bilateral trade-agreements are implemented in a manner that does not impede such access. The vulnerabilities of the poor also mean that work-related accidents often plunge entire extended families into extreme poverty. According to ILO, some 2.2 million people worldwide succumb to work-related accidents or diseases every year. Some 160 million are victims of work-related illnesses and around 270 million occupational accidents occur annually. One can, therefore, appreciate the scale of the problem. The basic work of trade unions, to ensure compliance with health and safety regulations at work, is, therefore, a crucial contribution to poverty-reduction.

Heins (2004) reported that since United Nations Conference on Environment and Development (UNCED), labour unions have engaged in a wide range of activities. For example, labour union members have participated in sessions of OECD, FAO, WHO, WTO, ILO and UNEP that address the issue of sustainable consumption and production. Moreover, they have been involved in a large number of national and local initiatives to promote mainly the social pillar of sustainable consumption and production. Additionally, represented by the ICFTU, they have been actively involved in the CSD (Conference on Sustainable Development) mechanism since 1996 when the ICFTU for the first

time coordinated the input of labour union to the CSD as a one-hour 'Day of the Workplace' session. The contribution in 1997 was a session themed 'Trade Union Dialogue'. In the following years, labour unions' input to the CSD focused on the role of workers and unions with respect to concrete thematic aspects of sustainable development, such as Business and Industry (1998), Sustainable Tourism (1999), Food and Agriculture (2000), and Sustainable Energy, and Transportation (2001). Over the years, not only ICFTU and Trade Union Advisory Committee (TUAC) to the OECD participated in the dialogue sessions with other stakeholders, but also other international unions representing various industrial sectors.

Social Role in Alleviation of Poverty

Ebbinghaus (2002) expressed the view that unions use their institutionalized involvement in social policy-governance in order to advance their interests in the ongoing reform process.

According to World Bank (1995), the struggle against poverty is intrinsic to the trade unions' mission and they have actively engaged in poverty-alleviation strategies throughout their history. While concurring that the consequences of union activity will vary from country to country, Aidt and Tzannatos (2001), using evidence predominantly drawn from the OECD countries, acknowledge that trade unions can smooth out the employer-employee relationship through their actions to enforce agreements and by providing channels for employees to voice their grievances. Moreover, through policy-dialogue trade unions make representations to governments and international agencies and campaign for pro-poor policies, monitor them and promote the formulation of alternative ones.

According to ILO (2005), the organizing work of trade unions is one key-effort at poverty-eradication. The more organized the workers are the better they can determine their own destiny as they best understand their own economic and political situation. The ILO report further revealed that trade unions are a crucial part of the fight against poverty and their actions contribute to regulation of global economy. Trade unions together with other organizations are involved in the 'Global Call to Action against Poverty', and campaign for extended debt-cancellation for all low-income countries without IMF/World Bank structural adjustment conditionalities. Historically, trade unions have equitable redistribution of the gains from economic growth, reducing poverty amongst the lowest wage-earners through their collective bargaining activities. This involves initiatives such as organizing unemployed youth in the informal economy, organizing market women and establishing coalitions with peasant associations. These initiatives include targeted programmes, aimed directly at the poor or at the working poor, involvement in campaigns or collective bargaining in order to defend and promote rights at work, and policy interaction at national or international levels, in order to create the conditions for poverty eradication and for pro-poor policies. The earliest benefits that trade from unions from the United States and the United Kingdom offered included providing resources for a decent burial and the campaign for good public education for children.

According to Knowles and Eade (n.d.), many of the large European and North American labour unions and global or regional union federations also raise funds from their members for aid and development work. These are far too many to be described individually, but some of the most important include AFCSME, AFL-CIO and the United Electrical, Radio and Machine Workers of America (UE) in the United States; the Deutsche Gewerkschaftsbund in Germany; the Federatie Nederlandse Vakbeweging in the Netherlands; the Trade Unions Congress in the UK; and many unions in Scandinavia. Some of these have formed specialist development organizations, such as Norwegian People's Aid (NPA) networks, and special union funds, such as the Steelworkers' Humanity Fund, founded by the United Steelworkers of Canada, whose members donate 40 cents a week on the basis of which co-funding from the government is leveraged, currently running at a total of CA$5 million, annually.

Role in Training, Education and Skill Building

According to some researches, unions are also taking interest in workers' training, education and skill building, convincing either government or employers to arrange training or arranging training programmes themselves to build their skill and enhance the earning capacity of workers. Aidt and Tzannatos (2001) wrote that unionized workers tend to receive more training than their non-unionized counterparts, especially company-related training.

According to CSD (1998) and WSSD (2002), in India 'West Bengal Cha Mazdoor Sabha' (union) educates its members on the safe use of agro-chemicals and workers' rights. Port and dockworkers of the Hind Mazdur Sabha (HMS) educated and organised cargo handlers, in response to illegal imports of hazardous goods.

Wong (2000) stated that in Singapore, unions urged employers to invest in training of workers and also negotiated training clauses in collective agreements and sought to ensure higher subsidies for training low-skilled/low-income workers. She further wrote that unions urged workers to enhance their skills as a means to ensure employment-security by keeping pace with changing job requirements and to increase their earning capability in the longer term. To help workers to remain employable throughout life by providing nationally certified skill-training, National Trade Union Confederation approached employers to sponsor their employees for Skills-Upgrading Programmes in December 1996. On 30th June 1999, a total of 288 companies had committed 21,800 workers for Skill Redevelopment Programme (SRP) training in five general launches and nine sectoral launches, since December 1996.

According to Katz, et. al., (1993), in many countries unions are effectively involved in vocational education programmes. Adji (2002) reported that in Niger, the USTN (Union des Syndicats des Travailleurs du Niger) is running a project to provide low-cost training to workers. The USTN is also running a training school and an agricultural project.

According to WSSD (2002) in the Czech Republic, the Mine, Geology and Oil Industry Workers' Union's "Train the Trainers Programme" extends awareness into the community. Russian and Norwegian unions cooperate in the Barents Region to provide training and job experience for Russian workers, engineers and advisers in Cleaner Production (CP) technology, waste minimization, energy conservation, and sound ecological processes.

Mishel and Walters (2003) were of the opinion that unions also created awareness about laws regarding health, such as in USA about FMLA's existence and regulations.

Booth, et. Al., (2003), using data of British Household Panel Survey 1991-96, found that union-covered workers were more likely to receive training and also received more days of training relative to non-covered workers. Among workers who received training, those with union-coverage enjoyed greater returns to training and higher wage-growth than did those without it.

Trade Union Congress (TUC) (2006), in a briefing paper, reported that union presence has a significant impact on the incidence of training. Analysis of the 2003 Labour Force showed that 39% of union members had been engaged in some training in the previous three months, compared to only 26% of non-unionized employees. TUC also reported that employees get more training when the issue is negotiated with employers through unions, rather than employers simply consulting the unions about the organization's training strategy. TUC referred to a research by Francis Green 1996 which demonstrated that unionized workplaces were 17% more likely to have a training centre and 11% more likely to have a training plan. TUC referred to other studies showing that training is more likely to deliver benefits to members when unions not only secure recognition from the employers but also play an active role in taking decisions about what is provided.

The participants of the conference on sustainable development acknowledged that trade unions have developed capacity for work-place centred education because unions are the foremost providers of adult education in many countries (CSD, 2001).

The discussants of Regional Meeting (1999) threw light on the potentially significant role of unions towards building social cohesion through establishing institutions for skill development, mobilization of investable resources, and through the development of cooperatives aimed at the provision of housing, credit and consumer services.

Fahlbeck (1999) evidenced it by reporting that, in Sweden, the extensive training and education programmes are conducted by virtually all unions. LO, for example, has a wide range of educational programmes and runs several schools. Anyemedu (2002) also reported that, in Ghana, the TUC has made the education of the members one of its priority concerns.

ILO (2005) reported that a number of labour unions have made undertakings for education, awareness raising and advocacy. In Colombia, in 1995, reacting to the massive wave of dismissals from government institutions, the Women's Bureau of the Single Confederation of Workers of Colombia (CUT) started working out strategies to provide the labourers with vocational training. This gave birth to the House for Working Women Heads of Household (Casa de la Mujer Trabajadora Jefa de Hogar), which later started to train women in non-traditional trades by means of programmes in finishing and silver plating, electrical fitting and graphic arts. Similarly, Argentina's Sindicato Único de Trabajadores de Edificios de Rentay

Horizontal (Single Trade Union of Concierges) (SUTERH) opened the Centre for Professional Education in 1992 to provide basic knowledge on occupational health and safety. In 1999, SUTERH established the Higher Education Institute and currently offers education in Applied Computing Sciences, Security and Hygiene at Work and Technician Degrees in Intelligent Buildings.

Unions have also given workers awareness about their rights, as Mishel and Walters (2003) quoted the view that union members were about 10% more likely to have heard of the FMLA (in USA) and understand whether or not they were eligible. This is because of awareness given to them by unions.

Role in Human Rights

Swedish unions are at the forefront in promoting human rights, including union rights. They strongly advocate the inclusion of basic ILO Conventions in international instruments, such as the WTO charter (Fahlbeck 1999).

SOCIAL ROLE OF TRADE UNIONS IN PAKISTAN

Pakistani unions APFOL (All Pakistan Federation of Labour), PWF (Pakistan Workers Federation having one million members) with the sponsorship of foreign unions like Italian union CISL (Confederazione Italiana Sindacati Lavoratori) through its NGO named ISCOS (Instituto Sindacale Per La Cooperazione Allo Sviluppo), Japanese Union Rengo, Swedish Federation of Trade Unions, LO (Landsorganisationen i Sverige) and Danish union FTF (Confederation of Salaried Employees and Civil Servants) did work in social sector beyond collective bargaining, as listed below.

Healthcare

In Pakistan, the Italian trade union CISL through ISCOS (which is its NGO), in collaboration with Pakistani trade unions, rendered services in healthcare. Under 'Primary Health Care Project for Afghan Refugees 2002-2004', ISCOS set up and equipped a clinic with medical staff in Afghan refugee camp at Khakki Village (District Mansehra of NWFP province). Moreover, ISCOS, under ISCOS-CISL/ Piemonte Afghan Refugees Project 2002-2006, set up three medical teams working in shifts to examine Afghan refugee patients of Nauthia (Peshawar) and Khurasan (FATA) camps.

Shelters and Orphanages

Under ISCOS-CISL's "Piemonte Afghan Refugee Project 2002-2006", ISCOS has built three family shelters in Peshawar to house 90 Afghan orphans. These orphanages provide them with healthcare, education and psycho-pedagogic counseling to move them towards a better future.

Services in Earth Quake

In October 2005, Pakistan suffered from a very disastrous earth-quake which, according to official record, claimed 87,000 lives including 19,000 children in schools. Besides this, thousands of innocent children were injured and hundreds of schools collapsed and became unfit for educational activities. Thousands of children became orphans and remained were left without any support. PWF (Pakistan Workers Federation) worked to help out the quake-trodden people by providing food, blankets, quilts and other items of daily use. ISCOS rebuilt two permanent schools in quake-affected districts of Mansehra and provided tents; learning material, such as books, notebooks, blackboards and tool kits for teachers; and helped in establishment of tent schools. During February-July 2006, a three-day orientation/training was provided to 9500 teachers in the earthquake-affected area.

Training and Skill Building

i. ***Training to Workers:*** CISL through ISCOS, during the three year period, provided training under the 'Trade Union Education Unit' of ISCOS to Pakistani workers and communities in the following fields:

- *Trade Union Education and Administration:* 18 master trainers (as instructors) and 90 trainers were imparted with specialized training in order to impart further training down the line. (Detail is enumerated in Table-1).

- *Organizing the Un-organized:* 18 master trainers (as instructors) and 102 trainers were imparted training to impart further training down the line. (Detail is enumerated in Table-2).

- *Collective bargaining/Tripartite Institutions and Social Dialogue:* 19 master trainers (as instructors) and 102 trainers were imparted training to impart further training down the line

Table - 1: Training Activities on "Basic Trade Union Education & Administration"

Training National / Regional	Schedule	Place	No. of Participants	
			Male	Female
National	15th - 19th Sep 2004	Islamabad	14	4
Regional	1st - 5th Oct 2004	Sialkot	14	4
Regional	30th Nov - 4th Dec 2004	Quetta	18	0
Regional	27th - 31st Dec 2004	Peshawar	15	3
Regional	15th - 19th Jan 2005	Lahore	15	3
Regional	9th - 13th Mar 2005	Karachi	13	5

Table - 2: Training Activities on "Organising the Unorganised"

Training National / Regional	Schedule	Place	No. of Participants	
			Male	Female
National	2nd - 6th Mar 2005	Islamabad	17	1
Regional	2nd - 6th Mar 2005	Peshawar	18	0
Regional	17th - 21st Apr 2005	Quetta	18	0
Regional	27th - 31st Jul 2005	Swabi	20	0
Regional	21st - 25th Aug 2005	Sialkot	20	4
Regional	30th Sep - 4th Oct 2005	Karachi	20	4

Table - 3: Training Activities on "Collective Bargaining through Economic and Financial Analysis

Training National / Regional	Schedule	Place	No. of Participants	
			Male	Female
National	2nd - 6th Jan 2006	Islamabad	15	04
Regional	30th Jan - 3rd Feb 2006	Khairpur Mirs	13	05
Regional	27th - 31st Mar 2006	Faisalabad	15	04
Regional	17th - 21 Apr 2006	Karachi	20	05
Regional	24th - 28th Apr 2006	Peshawar	18	02
Regional	18th - 22nd Dec 2006	Sialkot	12	08

(Detail is enumerated in Table-3).

- *Gender awareness:* 21 master trainers (as instructors) and 110 trainers were imparted training to impart further training down the line. (Detail is enumerated in Table-4).
- *HIV-AIDS & Family Planning:* 19 master trainers (as instructors) and 109 trainers were imparted training to impart further training down the line. (Detail is enumerated in Table-5).
- *Economic Literacy:* 19 master trainers (as instructors) and 126 trainers were imparted training to impart further training down the line. (Detail is enumerated in Table-6).
- *Trade Union Finance:* 726 trainers were imparted training to impart further training down the line. (Detail is enumerated in Table-7).
- *Civic education for Labour Councillors:* 289 trainers were imparted training of labour laws and civic education to impart further training

Table - 4: Training Activities on "Gender Sensitization"

Training National / Regional	Schedule	Place	No. of Participants	
			Male	Female
National	12th - 16th June 2006	Islamabad	12	9
Regional	6th - 10th Aug 2006	Quetta	10	10
Regional	6th Nov - 10th Nov 2006	Sialkot	11	13
Regional	5th Dec - 9th Dec 2006	Karachi	11	9
Regional	20th Jan - 24th Jan 2007	Peshawar	13	13
Regional	6th Feb - 10th Feb 2007	Faisalabad	11	9

Table - 5: Training Activities on "HIV/AIDS & Family Planning"

Training National / Regional	Schedule	Place	No. of Participants	
			Male	Female
National	26th Feb - 2nd Mar 2007	Islamabad	13	6
Regional	13th Mar - 17th Mar 2007	Hyderabad	14	7
Regional	26th Mar - 30th Mar 2007	Peshawar	17	3
Regional	10th - 14th Apr 2007	Quetta	22	0
Regional	14th May - 18th May 2007	Sialkot	11	13
Regional	28th Aug - 1st Sept 2007	Karachi	12	10

Table - 6: Training Activities on "Economic Literacy For Trade Unions"

Training National / Regional	Schedule	Place	No. of Participants	
			Male	Female
National	25th - 29th Jun 2007	Islamabad	16	3
Regional	28th Jul - 1st Aug 2007	Peshawar	18	3
Regional	6th - 10th Aug 2007	Quetta	20	0
Regional	21st - 25th Aug 2007	Lahore	13	9
Regional	26th - 30th Aug 2007	Karachi	15	7
Regional	9th - 13th Jul 2007	Sialkot	14	7
Regional	16th - 20th Jul 2007	Swabi	13	7

down the line to newly elected labour leaders. (Detail is enumerated in Table-8).

- *Training of Trainers (TOT) for Capacity Building:* ISCOS-CISL-PWF Project completed a batch-wise series of training modules. During this training series, 84 master trainers were trained by conducting 5 national training courses of 5 days each, in various industrial towns. These master trainers further trained 1341 (1255 male and 86 female) paralegal experts by conducting 26 five-day, 37 two-day and a three-day regional follow-up courses. (Detail of the courses conducted and trainees is given in Table-9).

Besides these, other programmes as per details given below were also launched for trainings of trainers:

- Five-day training of trainers (TOT) programme, conducted in Swabi from 13th to 17th August 2006;
- Five-day training of trainers (TOT) programme, conducted in Sialkot from 3rd to 7th September 2006;
- Five-day National Training of Trainers

Table - 7: One-Day forum on "Trade Union Finance"

Training	Schedule	Place	No. of Participants	
			Male	Female
Regional	8th Dec 2006	Islamabad	280	26
Regional	10th Jan 2007	Peshawar	96	10
Regional	1st Feb 2007	Khairpur	90	44
Regional	29th Sept 2007	Taxila	75	0
Regional	30th Sept 2007	Sialkot	60	45

Table - 8: One-Day forum on "Civic Education for Labour Councillors"

Training	Schedule	Place	No. of Participants	
			Male	Female
Regional	24th Sept 2005	Topi	36	03
Regional	25th Sept 2005	Karnal Sher Killi	48	08
Regional	28th Sept 2005	Lahore	73	21
Regional	1st Oct 2005	Swabi	92	08

(TOT) programme on "Basic Concepts of Human Workers Rights and International Labour Standards", conducted in Islamabad from 4th to 8th September 2006;

- Five-day TOT programme, conducted in Islamabad from 27th November to 1st December 2006.

- *Paralegal Training:* ISCOS, with cooperation of PWF (Pakistan Workers Federation), trained many union-leaders as paralegal persons by educating them in labour laws and got it approved from government of Pakistan for them to appear in labour courts to plead the cases for themselves or for their fellow-workers, as law-counselors despite having no formal law education. During these courses, 351 (327 male and 24 female) unionists were trained. This effort will help those aggrieved workers who cannot afford heavy fees of professional lawyers. In this regard, three national and eighteen regional trainings were conducted in three phases in the years 2005 to 2007. Detail of the training activities under the 'Trade Union Education Unit' of ISCOS is enumerated in Tables-10-a, 10-b and 10-c.

  Labour unionists, trained in these courses, further conducted follow-up courses to train other labour unionists as paralegal workers.

- *Occupational safety, health and environment (OSHE):* ISCOS imparted a five-day and a two-day training on occupational safety, health and environment, covering the topics of industrial accidents and precautionary measures to avoid them, first aid, material handling, safety guards, utilizing natural resources at work place, pollution-free workplace, emergency help, significance of OHS in charter of demand, and national and international laws relating to OHS. During these trainings, 700 industrial workers in different enterprises of Gadoon industrial estate and 840 industrial workers in different enterprises of Sialkot industrial estate were trained. ISCOS conducted courses for the workers of mines on Mines Safety, in collaboration with Swedish Labour Federation (LO) and Danish Workers Federation (FTF) and Pakistan Workers Federation (PWF).

ii. Training to other communities: CISL/ISCOS, under the project "Support for Afghan Refugee and Hosting Communities March to August 2006", provided vocational training in marketing skill to Afghan and Pakistani communities in Peshawar districts and Kurram and Bajaur agencies, so that they can successfully run their businesses after returning to their country.

Gender Sensitization

In Pakistan, sensitizing the trade unions regarding gender is the only way to improve their membership in

Table - 9: Trainers Training Module (TTM- 1 to 3) and their follow up
List of Activities held at Sialkot Industrial Estate, Gadoon Industrial Estate, District Swabi, Hattar Industrial Estate, Haripur and Hub Industrial Estate, Balochistan

S. No	Activity	Place	From	To	No. of Days	No. of Participants
1	Trainers Training Module-I (TTM-I) National Training	Gadoon (Swabi)	28-Jan-05	1-Feb-05	5	22
2	Trainers Training Module-I (TTM-I) National Training	Sialkot	11-Feb-05	15-Feb-05	5	20
3	2-Day Follow up Training Programme of TTM-I	Fauji Corn Complex, Gadoon	17-Feb-05	18-Feb-05	2	20
4	2-Day Follow up Training Programme of TTM-I	Marble Mines Tarakoh,Gadoon	22-Feb-05	23-Feb-05	2	20
5	2-Day Follow up Training Programme of TTM-I	Al Mozamal Steel, Gadoon	24-Feb-05	25-Feb-05	2	20
6	2-Day Follow up Training Programme of TTM-I	Bilal Chemical Gadoon	26-Feb-05	27-Feb-05	2	28
7	2-Day Follow up Training Programme of TTM-I	Gadoon Textile Mills Gadoon	6-Mar-05	7-Mar-05	2	25
8	2-Day Follow up Training Programme of TTM-I	Almuzamal Steel Corp.Gadoon	11-Mar-05	12-Mar-05	2	20
9	2-Day Follow up Training Programme of TTM-I	Saif Textile mills Gadoon	19-Mar-05	20-Mar-05	2	23
10	2-Day Follow up Training Programme of TTM-I	Vision Technologies Corp. Sialkot	21-Mar-05	22-Mar-05	2	20
11	2-Day Follow up Training Programme of TTM-I	Swabi	23-Mar-05	24-Mar-05	2	20
12	2-Day Follow up Training Programme of TTM-I	Haripur	26-Mar-05	27-Mar-05	2	20
13	2-Day Follow up Training Programme of TTM-I	Talon Sports Sialkot	26-Mar-05	27-Mar-05	2	20
14	2-Day Follow up Training Programme of TTM-I	Karnal Sher Killi Distt.Swabi	28-Mar-05	29-Mar-05	2	20
15	2-Day Follow up Training Programme of TTM-I	Pokal Industries Sialkot	28-Mar-05	29-Mar-05	2	20
16	2-Day Follow up Training Programme of TTM-I	Gadoon (Swabi)	30-Mar-05	31-Mar-05	2	20
17	Trainers Training Module-I (TTM-II) National Training	Gadoon (Swabi)	7-Apr-05	11-Apr-05	5	14
18	2-Day Follow up Training Programme of TTM-I	Saga Sports Sialkot	2-Apr-05	3-Apr-05	2	20
19	2-Day Follow up Training Programme of TTM-I	Saga Sports Sialkot	9-Apr-05	10-Apr-05	2	20
20	2-Day Follow up Training Programme of TTM-I	Modesty Sports Sialkot	13-Apr-05	14-Apr-05	2	20
21	2-Day Follow up Training Programme of TTM-I	Tramondi Sports Sialkot	16-Apr-05	17-Apr-05	2	20

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22	2-Day Follow up Training Programme of TTM-I	United Surgical Sialkot	21-Apr-05	22-Apr-05	2	20
23	2-Day Follow up Training Programme of TTM-I	Hemalia Trading Co. Sialkot	23-Apr-05	24-Apr-05	2	20
24	2-Day Follow up Training Programme of TTM-I	Forward Sports Sialkot	25-Apr-05	26-Apr-05	2	20
25	Trainers Training Module-I (TTM-II) National Training	Sialkot (Swabi)	6-Jul-05	10-Jul-05	5	14
26	Trainers Training Module-I (TTM-II) National Training	Gadoon (Swabi)	14-Jul-05	18-Jul-05	5	14
27	5-Day Follow up Training Programme of TTM-II	(Swabi)	7-Dec-05	11-Dec-05	5	20
28	5-Day Follow up Training Programme of TTM-II	(Swabi)	26-Dec-05	30-Dec-05	5	20
29	5-Day Follow up Training Programme of TTM-II	Gadoon (Swabi)	06-Jan-06	10-Jan-06	5	20
30	5-Day Follow up Training Programme of TTM-II	Gadoon (Swabi)	23-Jan-06	27-Jan-06	5	20
31	5-Day Follow up Training Programme of TTM-II	Gadoon (Swabi)	06-Feb-06	10-Feb-06	5	20
32	5-Day Follow up Training Programme of TTM-II	Gadoon (Swabi)	20-Feb-06	24-Feb-06	5	20
33	5-Day Follow up Training Programme of TTM-II	(Swabi)	06-Mar-06	10-Mar-06	5	20
34	5-Day Follow up Training Programme of TTM-II	Gadoon (Swabi)	20-Mar-06	24-Mar-06	5	20
35	2-Day Follow up Training Programme of TTM-II	Gadoon (Swabi)	04-Feb-06	05-Feb-06	2	24 (Female)
36	2-Day Follow up Training Programme of TTM-II	Gadoon (Swabi)	25-Mar-06	26-Mar-06	2	20 (Female)
37	5-Day Follow up Training Programme of TTM-II	Sialkot	08-Dec-06	12-Dec-06	5	21
38	5-Day Follow up Training Programme of TTM-II	Sialkot	21-Dec-06	25-Dec-06	5	21
39	5-Day Follow up Training Programme of TTM-II	Sialkot	24-Jan-06	28-Jan-06	5	21
40	5-Day Follow up Training Programme of TTM-II	Sialkot	17-Jan-06	21-Jan-06	5	20
41	5-Day Follow up Training Programme of TTM-II	Sialkot	14-Feb-06	18-Feb-06	5	21
42	5-Day Follow up Training Programme of TTM-II	Sialkot	27-Mar-06	31-Mar-06	5	21
43	5-Day Follow up Training Programme of TTM-II	Haripur	09-Apr-06	13-Apr-06	5	20
44	2-Day workshop on Gender Awareness	Gadoon	22-Apr-06	23-Apr-06	2	20 (Female)
45	2-Day workshop on organized the un-organized	Gadoon	26-May-06	27-May-06	2	22 (Female)
46	2-Day Follow up Training Programme of TTM-I	Sialkot	26-Jan-07	27-Jan-07	2	21
47	2-Day Follow up Training Programme of TTM-I	Sialkot	29-Jan-07	30-Jan-07	2	21

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48	2-Day Follow up Training Programme of TTM-I	Sialkot	6-Feb-07	7-Feb-07	2	23
49	2-Day Follow up Programme of TTM-I	Sialkot	27-Feb-07	28-Feb-07	2	23
50	2-Day Follow up Training Programme of TTM-I	Sialkot	6-Mar-07	7-Mar-07	2	21
51	2-Day Follow up Training Programme of TTM-I	Sialkot	8-Mar-07	9-Mar-07	2	22
52	2-Day Follow up Training Programme of TTM-I	Sialkot	13-Mar-07	14-Mar-07	2	22
53	5-Day Follow up Training Programme of TTM-II	Sialkot	19-Mar-07	23-Mar-07	5	23
54	2-Day regional Training Programme of TTM-I	Sialkot	29-Mar-07	30-Mar-07	2	22
55	5-Day Follow up Training Programme of TTM-II	Sialkot	3-Apr-07	7-April-07	5	18
56	2-Day Training Programme on OSHE	Hub, Balochistan	10-Apr-07	11-April-07	2	21
57	2-Day Follow up Training Programme of TTM-I	Sialkot	09-Apr-07	10-April-07	2	21
58	3-Day Training Programme on OSHE for Local bodies	Swabi	20-Apr-07	22-April-07	3	23
59	5-Day Follow up Training Programme of TTM-II	Sialkot	12-June-07	16-June-07	5	19
60	5-Day Follow up Training Programme of TTM-II	Sialkot	10-July-07	14-July-07	5	21
61	5-Day Follow up Training Programme of TTM-II	Sialkot	17-July-07	21-July-07	5	21
62	5-Day Follow up Training Programme of TTM-II	Sialkot	07-Aug-07	11-Aug-07	5	21
63	5-Day Follow up Training Programme of TTM-II	Sialkot	14-Aug-07	18-Aug-07	5	20
64	5-Day Follow up Training Programme of TTM-II	Sialkot	21-Aug-07	25-Aug-07	5	21
65	2-Day Training Programme of OSH	Hub, Balochistan	24-Aug-07	25-Aug-07	2	21
66	5-Day Follow up Training Programme of TTM-II	Sialkot	27-Aug-07	31-Aug-07	5	20
67	5-Day Follow up Training Programme of TTM-II	Sialkot	3-Sept-07	7-Sept-07	5	10
68	5-Day Follow up Training Programme of TTM-II	Sialkot	8-Sept-07	12-Sept-07	5	18
69	2-Day Training Programme on OSHE	Hub, Balochistan	13-Sept-07	14-Sept-07	2	21

the unions. Women participation in trade-unions is negligible and in labour leadership it is almost at zero level. For building active women-participation in trade unions, PWF (Pakistan Workers Federation), the cooperation of ILO (International Labour Organization), developed 120 women labour-leaders by conducting workshops in Quetta, Hyderabad, Karachi, Rawalpindi, Peshawar and Lahore.

Organizing the Un-organized

According to ILO (2005), organizing the work of trade unions is one key-effort for poverty eradication. More organized the workers are, the better they can determine their own destiny, as they best understand their own economic and political situation. The ILO

Table - 10(a): Paralegal Training Programme-Phase I

Training National / Regional	Date	Place	No. of Participants	
			Male	Female
National	5th - 9th Jan 2005	Islamabad	17	1
Regional	21st - 25th Feb 2005	Islamabad	18	0
Regional	27th - 31st Mar 2005	Peshawar	16	2
Regional	17th - 31st Apr 2005	Quetta	18	0
Regional	30th Sept - 4th Oct 2005	Karachi	15	3
Regional	15th -19th Nov 2005	Lahore	19	0
Regional	15th - 19th May 2006	Quetta	18	2
Regional	11th - 15th Feb 2007	Hyderabad	26	0

report further revealed that trade unions are a crucial part of the fight against poverty and their actions contribute to regulation of the global economy. In this regard, ISCOS organized the un-organized workers by setting up/registering 65 new trade unions and 13,500 new members of unions, and making workers aware of their rights and duties, according to national and international legislation.

Abolishing Child-Labour/Children Education and Awareness

Pakistani trade union APFOL (All Pakistan Federation of Trade Unions), with sponsorship of Japanese trade unions Rengo-(JILAF), exerted efforts for child-labour elimination and rehabilitation of these children. They provided education upto Matric (10th class) to 80 children working in brick kilns. ISCOS, under “Block Grant Project January 2006 to December 2008”, established 3 new middle schools (up to 8th class) for children working in carpet-weaving sector and provided education on health and basic human rights through rehabilitation centres, and basic education and skills for working/street children to improve their living conditions in Pakistan. Families of child-labourers were provided with a monthly stipend, in order to prevent exploitation of these children.

Human Rights/Workers Rights

APFOL (the present PWF) and ISCOS co-funded by EC worked for giving awareness to workers about their rights. For strengthening civil-society participation to promote and defend workers’ rights, a five-day national training programme titled "Basic Concepts of Human, Workers’ Rights and International Labour Standards", was held in Islamabad on 8th September 2006. In total, 20 participants, representing various NGOs/CBOs from all over Pakistan, benefited from the training.

During three-year period from 2004 to 2007, a series of (12) national-level trainings were conducted by the ISCOS-CISL in collaboration with NGOs. Courses

Table - 10(b): Paralegal Training Programme-Phase II

National / Regional Training	Date	Place	No. of Participants	
			Male	Female
National	14th - 19th Dec 2005	Islamabad	11	0
Regional	24th - 28th Jan 2006	Karachi	10	5
Regional	20th - 24th Feb 2006	Lahore	15	0
Regional	28th Feb - 4th Mar 2006	Peshawar	14	3
Regional	25th - 29th Mar 2006	Islamabad	14	0
Regional	13th - 17th Mar 2007	Hyderabad	24	0

Table - 10(c): Paralegal Training Programme-Phase III

Training National / Regional	Date	Place	No. of Participants	
			Male	Female
National	9th -13th Sept 2006	Islamabad	10	0
Regional	5th - 9th Dec 2006	Karachi	11	5
Regional	18th - 22th Dec 2006	Sialkot	11	0
Regional	10th - 14th Jan 2007	Peshawar	14	3
Regional	6th - 10th Feb 2007	Faisalabad	14	0
Regional	10th - 14th Apr 2007	Quetta	12	0
Regional	16th - 20th Apr 2007	Hyderabad	20	0

were conducted on workers' rights in collaboration with NGOs, viz., 'Takhleeq Foundation' (partner NGO in Sindh province), De Lass Gull' (Partner NGO in NWFP Province), 'BEEJ', Quetta (partner NGO Balochistan province), 'SUDHAAR' (partner NGO Punjab province) and 'SHARP' (partner NGO Federal Area, Islamabad). The purpose of these trainings was to train 60 master trainers, who further trained 400 local level trainers to disseminate the message on workers' rights at the grass-roots level.

Other Services

Community Meetings for Farmers Co-operatives Societies and Women Organization: A series of community meetings, for raising awareness, began with farmers and women workers in various regions. During the reporting period, nine community meetings were held in various rural areas of Pakistan, especially in Sindh and Balochistan, in order to disseminate messages for the protection of the rights of workers and to give the opportunity to women to speak about their problems. The total number of participants in these activities was 764, including 230 males and 534 females.

Publications/Literature Development: ISCOS, with the cooperation of European Community and Pakistan Workers Federation to build awareness among workers and other people, also compiled and published booklets in simple Urdu and English language . These publications are:

a. Manual on Para Legal issues;
b. Booklet on Gender Sensitization;
c. Manual on Trade Union Finance. (This Manual deals with key topics, such as sources of funds, income and expenditures of funds, budget presentation and trade unions financial strategy);
d. Manual on Teachers' Training;
e. Economic and Fianancial Analysis, through Collective Bargaining;
f. HIV AIDS and Family Planning ;
g. Economic Literacy for Workers;
h. Organize the Unorganized;
i. Gender Sensitization;
j. Occupational Safety, Health and Environment;
k. Mines Safety for Mine Workers;
l. First Aid ;
m. Child Labour;
n. Cooperative Societies;
o. Political Advocacy;
p. Trade Union Finance;
q. Civic Education; and
r. Health and Hygiene.

DISCUSSION AND CONCLUSION

From the descriptive sections 3.1 to 3.3, it is clear that unions have been taking part in social work like poverty-alleviation, healthcare, and training and skill-building. Similarly, it may be noted in section 4.1 to 4.8 that many European unions, such as Italian union CISL through ISCOS (its sponsored NGO); Swedish Union LO; and Danish union FTF in collaboration and cooperation with Pakistani unions (such as PWF unions), work for health-care of the public. These activities are aimed at training the public in different fields and building their skills, organizing the unorganized workers, educating them about their rights, elimination of child labour, gender sensitization, and reaching women workers and training them for taking part in unions' activities. Unions have also worked in helping earthquake victims, developed orphanages, medical camps and helped in development of tent-schools for children in

earthquake-affected areas of Pakistan.

Greater effort is, no doubt, needed in several badly neglected areas, which can be made by enhancing the role of unions in combating poverty, environmental degradation and illiteracy. Nevertheless, it is clear that unions, besides seeking benefits for their members under collective bargaining, also take part in various activities of social welfare. Therefore, we reject the null hypothesis, i.e., "unions are socially dull bodies, exerting efforts only for seeking benefits for their members, and establish the alternate view, i.e., "Unions are not socially dull bodies, and also exert efforts for social welfare besides seeking benefits for their members".

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Sources of Data

Data about unions' work in Pakistan have been gathered by interviewing official of ISCOS and PWF and from reports of ISCOS.

In addition, the following persons were interviewed

1. *Dr. Ishaque Education Advisor ISCOS Pakistan*
2. *Mr. Nauman an official of ISCOS*
3. *Mr. Zahoor Awan Secretary General PWF (Rawalpindi)*

"DARWINISM" IN THE YEAR 2009: 150 YEARS AFTER DARWIN'S BOOK "THE ORIGIN OF SPECIES"

*Imtiaz Ahmad**

ABSTRACT

On November 24, 2009, Darwin's magnum opus (Latin for 'great work') on "The Origin of Species" would reach 150 years as Darwin, on February 12, 2009, would have turned 200 years old. In the midst of celebrations of 200 years of Darwin throughout the globe, it would probably be appropriate to look into the evolving Darwinism. No doubt, Darwin recognized how life-forms adapt and survive, but he made only a little inroad into the problem of "the evolutionary change", despite the title of his magnum opus. No doubt, he recognized that variation and heredity were the twin engines that made evolution possible but he did not know what made them possible. In this article, we take a look at some aspects of this problem, keeping in view the ideas taught in schools and colleges.

INTRODUCTION AND HISTORICAL DISCUSSION

"Darwinism", or the theory of natural selection and survival of the fittest, was fully explained and exemplified in 1859, about 150 years from now. The theory has been tested since and, in many experiments, has been proven beyond all doubts in the last 150 years. Actually, the theory was introduced for the first time in 1858 by Charles Darwin and Alfred Russell Wallace. Wallace independently found in his observations on animals in the East of Wallace's Line (Australia and Australian New Guinea) that species change through Natural Selection. Like Darwin, Wallace also based his theory on reasons derived through his observations. After he completed his manuscript explaining his theory, he sent it to Darwin for critical comments before publishing it. Darwin was so impressed by this manuscript that he was about to give his 'go ahead' signal to young Wallace but, luckily, before doing so he shared his thoughts with his friends Joseph Hooker, a botanist, and Charles Lyell, a geologist. Explaining and analyzing his observations during his mission on Beagle (a ship) to South American Galapagos Island, the two convinced Darwin to wait a little before renouncing the credit for his painstaking work. As quoted in Darwin's Finches, "The two friends of Darwin approached and convinced the young Wallace to share his theory with the Great Darwin who, by publication of Wallace's book, would have lost the entire credit for his 15 years of hard work". Finally, with the arrangements made, the Darwin-Wallace venture on "The Origin of Species by Means of Natural Selection", or "The Preservation of Favoured Races in the Struggle for Life" was presented on 1st June 1858. The next year, Darwin then hurriedly finalized his book and mailed it to his publisher, but that did not really mean that work on evolutionary biology reached its peak, just as Zimmer (2009) beautifully remarked that medicine peaked when Louis Pasteur demonstrated that germs cause diseases.

DARWIN AND MENDEL

Darwin certainly did recognize that variations and heredity were the twin engines that made evolution possible, but he did not know what made them possible. It was about a century later that scientists found the answer, i.e., the "DNA". Darwin actually did not have any clue about the mechanism of heredity. It was Gregor Mendel who presented his "Laws of Inheritance" during a seminar in 1865. When the proceedings of the seminar were published (1865), every library of Europe and USA received a copy of this publication. Darwin must have seen a copy of the "Laws of Inheritance", but surprisingly in his "Descent of Man and Domestication of Animals" (1871), six years after Mendel's publication, Darwin advocated his theory of "Pangenesis" as the mechanism of heredity. It was based on the theory of "Gemmules" secreted by each cell of the body and with the blood-circulation the cell replicates, i.e., "gemmules" reach and are concentrated in the reproductive organs, whether the testes or ovaries, in the form of sperms or ova, respectively. By the fertilization of these sperms and ova the child resembled his parents–a sheer replica of "Lamarckism". Dalton, a Darwin fan, transfused blood of a black rabbit into a white rabbit hoping that the next progeny would all be striped or drab but, to his surprise, the next progeny was all white'.

After 34 years of Mendel's publication of the "Laws of Inheritance", when the world got matured enough to understand the mechanism of inheritance, Correns in Germany, Tschermak in Austria and De-Varies in Holland independently re-described Mendel's "Laws of Inheritance". When they dug their libraries to review and analyze their results, they got hold of Mendel's 34 years old publication and all three of them unanimously came up with the same title of their work, i.e., "Rediscovery of Mendel's Laws of Inheritance". Since then, these laws have been tested many a times, in different laboratories and all the experiments

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proved them right beyond all doubts.

DNA AND THE GENOME

Now the geneticists not only recognize how the traits are inherited, but they also know the four molecular letter codes of DNA, viz. the purine and two bases of pyrimidine. Today geneticists also understand how the impact of Natural Selection is imprinted on the DNA. They know how the DNA functions by instructing the cells to manufacture the proteins, some of which are structural, while the functional ones playing the role of enzymes. They also know how the DNA in the embryos form organs and organ systems. Moreover, they know that in human beings a lot of our genome is not made up of protein-coding genes; in fact 98.8% of it is not. Some of that 98.8% consists of "pseudogenes", genes that once encoded proteins but no longer can, because of "crippling mutation". Many mutations certainly produced winning effect of Natural Selection in producing traits which helped in survival of a species, but many, in fact a lot of mutations that all human genes underwent, neither helped nor harmed our ancestors. They spread just by chance, 98.9% of this junk DNA is in the form of LINES or SINES. Long DNA strands that copy themselves and then splice and reattach at various points of DNA strand are known as the "LINES" and short inter-spread strands of DNA are known as the "SINES". In humans, these segments have been insinuating themselves in the genetic code of life for billions of years. SINES contribute to this more than 10% and LINES more than 15%. They could have played a role in spawning some retroviruses, e.g., the AIDS viruses, which could have been generated from LINES. These have a unique value in mapping the twists and turns of evolution (Monarstersky, 1999; and Okada, et. al., 1999). By looking for particular examples of these copies in specific genome sites, researchers could determine when various species split off from related ones. With reference to the establishment of evolutionary relationship, even the conventional genetic analysis is not considered fool-proof. It goes awry when the same mutation occurs independently in two different species. It makes two animal sequences look similar, even though they may be only distantly related with a molecular version of convergent evolution. There could also be cases that a mutation in one spot could change again or even could correct itself, which would make the comparison of sequences much more difficult.

We are a long way from understanding the entire genome, but as we get to know a part of genome we get the understanding of how complex organs evolve. Zimmer (2009) quoted Darwin on how something as intricate as an "eye" could have evolved. But Darwin argued that new complex organs could evolve through a series of intermediate forms. Until 1980, biologists had almost no knowledge of the genes that built them. Over the past 25 years, biologists have identified many of the genomes that help build embryos. A number of genomes help layout an embryo's blue-print, by letting cells know where they are. Then cells absorb proteins floating around them and the signals trigger the cells to form other proteins which, in turn, clamp on to certain bits of DNA to switch the neighbouring genes on and off. This network of genes eventually leads a cell to give rise to an arm or a brain or a tongue (Zimmer, op.cit).

DISCUSSION

It is also surprising how Darwin chose the very title of his great book, "The Origin of Species by Means of Natural Selection", when Darwin did not have a clue of the concept of modern biological species. In his famous book, Darwin noted that when taxonomists found major morphological/taxonomical differences between two taxa, they called them different species and when they found minor differences they called them two different subspecies. Today we know well that two entirely different sympatric species, which never ever copulate with each other in nature, could be perfectly identical in their morphology. Actually, today we are familiar with thousands of cases of sibling species in different animal groups. Mayr (1963), Hackett (1937) and Bates (1940) have cited such examples among *Drosophila* and *Anopheles maculipennis* complex. Dobzhansky (1951) commented on this that Darwin was remarkably intelligent and he knew that the crux of the problem was of the origin and changes and modification in the species, and he could very well envisage that he could very easily win the battle on this front.

Although in Darwin's days very little progress was made in the field of palaeontology, but Darwin prophesied that different species share a common ancestry. Long after Darwin, the palaeontologists discovered: how the scene of evolution moved from sea to land vertebrates; how the fins evolved into hands and feet; how the fresh water bony "Crossopterygian" fish, like Eusthenopteron, evolved into first land amphibians; how the sluggish partly aquatic and partly terrestrial animals looking very similar to fish, the early amphibians, completing their life cycle in water and evolved into perfectly terrestrial

land reptiles, laying their eggs on land; how some of these early land reptiles evolved into mammal-like reptiles, i.e., therapsidans that finally evolved into reptile-like mammals. Even palaeontologists find it difficult to differentiate therapsidans and identify as reptiles or mammals (Moody, 1962). Finally, it was remarkable to see that, although the great monstrous reptilian stock, the monarchs of all they surveyed, the dinosaurs, which all perished and went into extinction, actually survive even today in the form of birds (Ahmad, 2009a). The palaeontologists have uncovered a series of fossils explaining the evolution of horses, elephants and camels. Thewissen, et. al. (2007) resolved the ever puzzling problem that some fish, like whales, dolphins and porpoises, actually evolved from even toed hoofed land mammalian group, the "Artiodactyla" (Ahmad, 2009b).

CONCLUSION

It is spectacular that almost every day paleontologists have been uncovering the ancestral stock of puzzling groups, about which those in Darwin's days the antievolutionists claimed "if evolution were true, we should have found the connecting links between every two groups evolutionists claim to have evolutionary relationship". They boasted after such remarks that these links are missing, because species were created separately and independently, and they are not evolutionarily related.

Today the strongest evidence of evolution comes from the field of paleontology. It is satisfying to note that we have marched much ahead in these 200 years of Darwinism.

IMPACT ON SCIENCE TEACHING

The present discussion may be concluded by recalling Prof. Michael Behe (2007), an American biochemist, who criticized the evolutionists, saying that many complicated organs of an animal's body could not be explained only on the basis of natural selection and probably a special designer would be needed to explain such intricate structures as the "human eye", but he also had to accept that the designer, alas!, could not be placed in an experimenter's test tube, to throw light on the personality of the designer. Today, "Evolutionary Biology" is no more a theoretical concept, but is based on hard facts of experiments, which could be repeated in different labs by different scientists who all obtain verifiable results. We are now in a position to incorporate these concepts in Biology courses in our schools.

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CHECKING SQUEEZE-OUT ZONE UNDER AN EMBANKMENT CONSTRUCTED AT SEABED AND ITS SLOPE-STABILITY ANALYSIS

Bazid Khan and Iftikhar Mehmood***

ABSTRACT

Embankments are laterally unsupported structural fills, usually constructed to support buildings, highways, dams, etc. When constructed under carefully controlled conditions, these may have the strength and supporting-capability as good as, or better than, many of the natural foundations. Construction of an embankment imposes shear-stress in the foundation. Determining the stability of the foundation, with respect to failure in shear, is an important factor for an embankment-design. The foundation-stability is estimated by comparing the magnitude of the induced stresses with that of available shear-resistance. Embankments may be built on the soft seabed for constructing building-sites or to support a highway formation. On such sites, the soft seabed material of negligible shear-strength cannot support the embankment load and, hence, with the increase in embankment height, the soft sub-soil starts to squeeze out through the toe.

This paper describes the checking of squeeze-out zone under an embankment that was constructed on seabed and raised to about 1.5 meters above the water- level in the sea to support roadway formation. At different locations, the width of the embankment varied from 45 to 100 meters and water-depth in the sea varied from 2.5 to 8.5 meters. By comparing the active forces (that tend to actuate squeezing) and passive forces (that tend to resist squeezing), a squeeze-out zone, about 3 meters deep, was found. Also, the slope-stability of the embankment was checked by using a software named 'STABL', which performed effective stress-analysis and displayed a factor-of- safety of 1.76 for the embankment.

Key Words: *Soil, slope-stability, squeeze, embankment.*

INTRODUCTION

Embankments are laterally unsupported fills, usually constructed to support buildings, highways, dams, etc. These may be constructed of various categories of natural soils, such as select fills, compacted clay, silt fills and rock fills (Monahan, 1994).

Starting from a leveled platform, the construction of an embankment imposes stresses in the foundation. There are direct stresses, but the stresses that concern us directly are the shear-stresses. As each lift of fill (embankment) is placed, it also increases the shear-stresses in earlier lifts adjacent to the sloping face of the embankment, as well as in the soil forming the foundation. These applied shear-stresses represent the tendency of the soil-slope to slide under the influence of gravity. For low fill-heights, the shear-stresses are much less than the shear-strength of the fill-material and of the foundation-soil, and shear-deformations are small. As the fill is raised, the ratio of the shear-stress to strength rises and, due to the non-linear relationship between stress and strain, deformation increases faster than the rate of mobilization of the available shear-strength. At some point in the construction-sequence, increasing fill-height will cause the application of stress equal to shear-strength in a part or parts of the soil. Extra load at the crest of the slope will then merely cause movement until the rising of the toe, and settlement of the head of the slide brings the soil-mass back into equilibrium, with the shear strength acting along the sliding surface. It may prove impossible to bring an increase in the height of the embankment and the result of placing more fill at the top is simply to cause a lateral spreading of the embankment-toes (Bromhead, 1986).

Determining the stability of foundation with respect to failure in shear and prediction of settlement to be expected, as a result of compression of the foundation-material, are the important factors in embankment-design (Hough, 1969). The foundation stability is estimated by comparing the magnitude of the induced stresses with that of available shear-resistance. The shearing stress, to which a foundation can be subjected, depends upon the unit-weight of the overlying materials and the geometry of the slope, while the shearing strength that can be mobilized to resist the shearing stress depends upon the character of the foundation-soil, its density and drainage conditions.

Movement of sloped soil masses can be classified into broad categories, depending on the type of motion relative to the adjacent or underlying earth. These may be in the form of slides, block- or wedge-failure and flows or spreads. Slides refer to the occurrence where the moving-mass is rather well-defined and spread from the underlying and adjacent earth by a plane or zone, comprising a number of adjacent planes, where slippage occurs. The slippage-plane or zone

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represents the continuous surface where the maximum shear-strength of the earth material has been reached that results in large displacement. The failure-mass remains essentially intact, although it may fracture into sub-units. Block- or wedge-failure refers to the displacement of an intact mass of soil because of the action of an adjacent zone of earth. Distinct blocks and wedges of soil may become separated from the adjoining earth because of the presence of cracks, fissures or joints, or even because materials having different properties are involved. Flow or spread are more complex types of soil-mass movements. A flow involves lateral movement of soil having the characteristics of a viscous fluid, although the actual consistency of the moving-mass may vary from very wet to dry. Spread refers to the occurrence of multi-directional lateral movements by fractured soil-mass (McCarthy, 1988).

Embankments may be constructed in water for different purposes, such as for breakwaters, for constructing building sites for housing on the very soft seabed, etc. (Teraet, 1996). When an embankment is constructed on saturated soft ground, pore-pressure is created due to the embankment load. If the embankment is constructed in a short period or undrained conditions, the factor-of-safety against failure is reduced due to the pore-pressure, and the most critical conditions arise at the end of construction. Figure-1 diagrammatically shows the variation of pore-pressure and factor-of-safety with time (Walker and Robifell, 1987).

With passage of time, the pore-pressure induced by construction dissipates and the effective stress increases. Consequently, the shear-strength of sub-soil (foundation soil) and factor-of-safety against slip-failure increases with time. Hence, the critical time for stability of embankments constructed in water is at the end of construction.

Stability problems of natural slopes and fill-slopes (embankments, earth dams and levees, etc.) or cut-slopes are commonly encountered in civil engineering projects. Because of its practical importance, the analysis of slope-stability has received wide attention in literature. Fall, et. al., (2006) presented a multi-method approach to study the stability of natural slopes and hazard assessment of land-slides. They found that the slides were influenced by the geo-

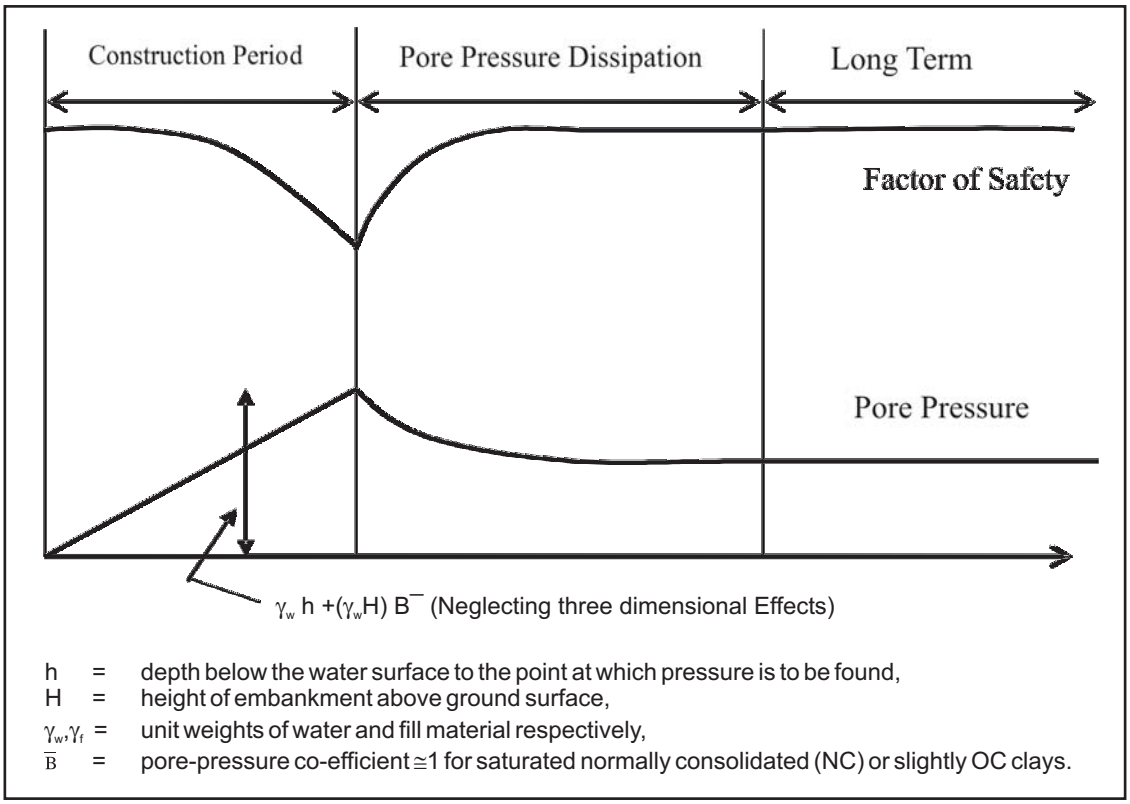

Figure - 1: Time-dependent Behaviour of Embankment

Figure - 2: Estimation of Over-consolidation Ratio from Liquidity Index (Wroth Concept)

For computing undrained shear strengths, the following correlation formulas are used:

$I_l = (w_n - w_p)/I_p$ .....(1)

$Su/\sigma'_0 = 0.11 + 0.0037I_P$ for normally consolidated clay.....(2)

$Su/\sigma'_0 = 0.11 + 0.0037I_P(OCR)^{0.8}$ for over consolidated clay [20].....(3)

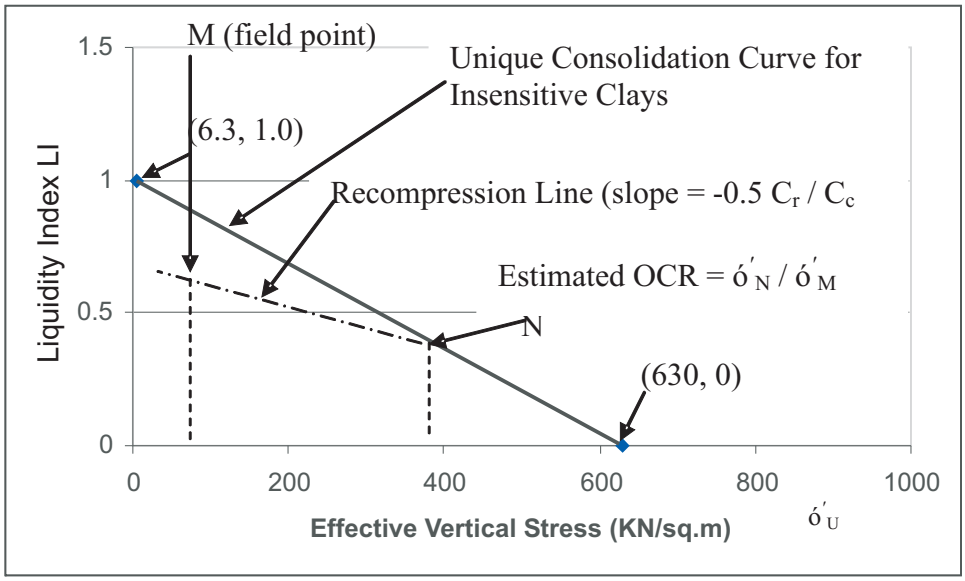

Figure - 2: Estimation of Over-consolidation Ratio from Liquidity Index (Wroth Concept)

technical properties of the soil along with other factors. Kvalstad, et. al., (2005) gave an overview of soil investigation, evaluation of potential trigger-mechanisms and stability-analysis in the Ormen Lange Area. Day (1992) presented a study on the effect of cohesion on stability-analysis for natural clay slopes and embankments. Park, et. al., (2005) developed a probabilistic analysis-procedure and related algorithms. They used this approach to analyze rock-slope stability for Inter-state Highway 40, North Carolina, USA. Durand, et. al., (2006) presented formulation, implementation and validation of numerical limit-analysis procedures for the study of stability-problems in soil and rock-masses. Kim, et. al., (1999) presented a finite-element formulation in terms of effective stress for limit-analysis of soil-slopes subjected to pore-water pressure. Radoslaw and Lei shi (1993) presented lower and upper-bound solutions for bearing-capacity of cohesive layers over rigid rough bases and proposed a method for calculations of embankments' failure-heights. Yu, et. al., (1998) compared the conventional limit equilibrium results with rigorous upper and lower–bound solutions for the stability of simple earth slopes. Kim, et. al., (2002) used limit-analysis method to compute lower and upper bound on the factors of safety for slopes with inhomogenous soil-profiles and irregular slope geometry, subjected to the effects of pore pressure. Huang, et. al., (2002) proposed a sophisticated and computer-oriented three-dimensional slope-stability analysis. Christian, et. al., (1994) derived a probabilistic description of soil-parameters from field and laboratory-data and applied it in stability-analysis. Griffiths and Fenton (2004) investigated the probability of failure of cohesive slope, using both simple and more advanced probabilistic analysis tool. Hsu and Nelson (2006) used stochastic field models and Monto Carlo simulation to understand the impact of the spatial distribution on excavation and slope-stability. When an embankment is constructed on a soft seabed, the upper zone of the soft seabed material has negligible shear-strength and cannot support the embankment load. Thus, with the increase in the embankment height, the soft sub-soil starts to squeeze out through the toe. This continues till the active and passive forces become equal.

EXPERIMENTAL PROGRAMME

An embankment called 'Kardon embankment' was constructed on soft seabed in the city of Izmir – Turkey. The construction work was carried out by a Turkish construction company named Bayinder Holding. The embankment was raised to about 1.5m above the

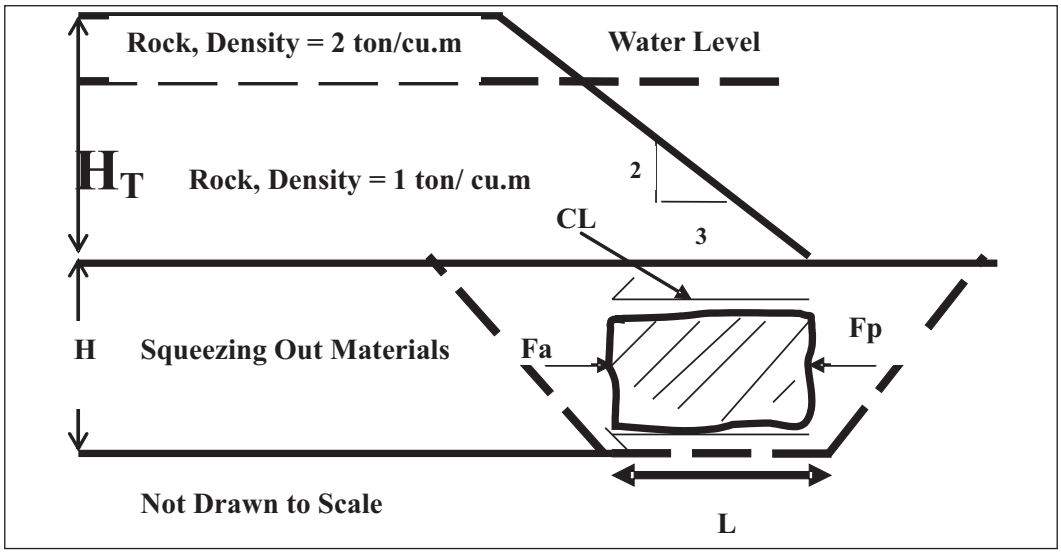

Figure - 3: Foundation Stability (Squeeze-out Zone)

water-level in the sea, to support roadway formation. The width of the embankment was varying from 45 to 100m and the depth of water in the sea was varying from 2.8 to 8.5m, at different locations along its length. Boring system was adopted for getting information about the soil below the seabed. Soil samples were taken at different depths and laboratory tests, including, Sieve analysis, liquid limit(w_l), plastic limit(w_p), undrained shear-strength(S_u) and compression index (C_c), etc., were performed. Some in-situ tests, such as standard-penetration tests and vane-shear tests, were also performed. As a whole, the soil was found to be soft to very soft clay, normally consolidated up to about 15m below the water. Somewhere at depths greater than 15m, thin sand-gravel layers were present, below which stiff over-consolidated clay was found down to greater depths/TBC.

OVER-CONSOLIDATION RATIO AND SHEAR-STRENGTH

Stability analysis requires information about the strength properties of the underlying soil-layers. The strength of soil-materials is dependent on the effective stress and the past consolidation. For computing over-consolidation ratio, Wroth Concept was adopted. Wroth suggests that the ratio of the recompression index C_r to the compression index C_c ranges from about 0.17 (for I_p = 15%) to about 0.34 (for I_p =100%). As shown in Figure-2, it is found, that remoulded soils have a more or less unique one-dimensional normal consolidation liner, which passes through an effective vertical stress of about 6.3kN/m^2 at a liquidity index of 1.0, and 630 kN/m^2 at a liquidity index of 0.0. In the Figure-2, the point M represents the in-situ condition of the soil and, by drawing the recompression line (of slope -0.5 C_r / C_c on this plot) through M to intersect the unique consolidation line, the point N may be found. The over-consolidation ratio (OCR) is then simply σ'_N/σ'_M.

SQUEEZE-OUT ZONE

When an embankment is constructed on a soft seabed, the upper zone of the soft seabed material has negligible shear-strength and cannot support the embankment load. Thus, with the increase in the embankment height, the soft subsoil starts to squeeze out through the toe. This continues till the active and passive forces become equal. Referring to Figure-3, the depth of squeeze-out zone under an embankment can be found by comparing the sum of active forces represented as F_a (the forces that actuate squeezing) to the sum of passive forces represented as F_p (the forces that resist squeezing). This concept gives the following equation:

$$qH - 2CH = 2CL + 2CH \quad \text{OR} \quad qH - 4CH = 2CL \text{.....(4)}$$

q = static overburden pressure (due to embankment load)
C = S_u = strength of the subsoil
L = length of the squeeze-out zone
H = depth/thickness of the squeeze-out zone

For small thickness of the squeeze-out zone, F_a is less than F_p and, therefore, the squeezing continues. With increasing thickness of the squeeze-out zone, there is a gradual decrease in F_a and an increase in F_p. At a certain thickness, both F_a, and F_p become equal and beyond this thickness F_a becomes less than F_p and, hence, whereon no further soil will squeeze out. The thickness, at which F_a and F_p becomes equal, is taken as the depth/thickness of squeeze-out zone.

RESULTS AND DISCUSSIONS

The results of various tests performed by Bayinder Holding on soil samples obtained from bore holes No. 3,6,7 and 9 are presented in Table-1. Some missing values have been calculated by making interpolation between the nearest upper and lower values.

This table indicates that the subsurface-soil mainly consists of clay having low plasticity, while sandy clay is also present at some depths. Traces of clay having high plasticity and silty clay are also found.

GEO-TECHNICAL SOIL PROFILE

A geotechnical soil profile is shown in Figure-4. The profile indicates the description of soil strata, soil-group symbols and graphs for w_l, I_P, w_n, S_u and N, plotted from the readings are given in the Table-1.

Table - 1: Laboratory Results

Serial No.	Depth	Bore Hole No.	Sieve Analysis		Atterberg's Limits			Natural Water Content	Group Symbol	Standard Penetration Resistance	Saturated Density
-	-	-	-No.4 sieve	-200 sieve	w_l	w_p	I_p	w_n	-	-	γ_{sat}
-	M	-	-	-	%	%	%	-	-	N	t/m^3
1	6	3	83.8	9.3	28	22	(12)	46.4	SC	1	1.74
2	7	6	84.8	22.3	41	28	13	(42)	SC	0	(1.45)
3	9	7	90.5	57.3	48	21	27	39.1	CL	3	1.80
4	10	6	93.1	74.8	48	24	24	63.9	CL	0	1.59
5	11	7	100	90.1	42	23	19	46.7	CL	4	1.74
6	12	9	99.9	92.7	50	28	22	47.8	CL,CH	4	1.73
7	13	6	91.8	63.4	50	29	21	62.6	CL,CH	4	1.60
8	14	9	100	94.0	40	23	17	46.8	CL	6	1.74
9	15	3	95.4	86.7	34	22	12	29.3	CL	18	1.93
10	16	7	97.4	68.4	33	21	12	20.5	CL	40	2.00
11	17	9	94.4	66.3	37	20	17	22.5	CL	24	2.03
12	18	9	100	56.9	36	20	16	28.5	CL	31	1.94
13	20	3	72	18.0	34	17	17	11.6	SC	87	2.26
14	22	9	100	74.2	37	20	17	28.1	CL	22	1.95
15	23	7	94.7	56.6	35	19	16	18.4	CL	34	2.01
16	24	3	99.4	67.2	26	19	7	21.7	CL,ML	21	2.08
17	26	3	97.8	88.1	33	17	16	25.3	CL	26	1.99
18	27	7	97.9	63.0	35	19	16	15.4	CL	38	2.16
19	30	6	99.4	74.5	38	20	18	26.8	CL	28	1.86
20	31	9	100	74.4	54.3	16.6	37	(24.3)	CH	40	1.92
21	33	3	99.4	82.6	46	20	26	22.6	CL	(50)	2.17
22	34	3	98.5	76.0	37	21	16	27.1	CL	55	1.97
23	35	3	90.4	50.9	26	17	9	13.4	SC,CL	40	2.25
24	36	9	85.8	49.8	32	18	14	17.3	SC	46	2.13
25	37	33	79.8	37.4	33	23	10	12.5	SC	34	2.24
26	38	7	95.0	66.6	34	15	19	16.8	CL	34	2.14
27	39	9	99.2	68.6	32	20	12	23.1	CL	52	2.04
28	40	9	53.5	32.9	32.1	15	16	15.0	SC	78	2.10
29	43	3	100	73.9	35	10	25	22.1	CL	36	2.22
30	45	6	71.7	47.0	26.2	13.5	14	13.6	SC	60	1.89
31	47	7	100	81.9	39	23	16	26.1	CL	48	1.98
32	49	7	100	92.6	40	24	16	28.0	CL	46	1.95

Note: Values in ( ) are calculated by interpolation

Depth (m)	Soil Description	Group Symbol
0.00 to 3.00	Sea water	
3.00 to 8.50	Very soft, black silty organic clay of low to intermediate plasticity	COI-COL
8.50 to 15.00	Very soft to soft. Greenish grey to dark, silty clay of low to intermediate plasticity	CI-CL
15.00 to 17.00	Stiff greenish, grey to grayish brown, fine gravelly, silty clay of low plasticity	CLG-CLS
17.00 to 23.50	Very stiff to hard, silty clay of intermediate plasticity to slightly to high clayey silt of low plasticity	ML-CL
23.50 to 29.50	Brown highly silty, fine gravely sandy clay of low plasticity to fine to medium grained clayey silty, sandy gravel	CLS-CLG - GWC-GWS
29.50 to 33.00	Very stiff hard yellowish brown highly silty clay of low plasticity. Occ.cons. some fine gravel	CL
33.00 to 34.50	Very stiff yellowish brown silty clay of intermediate plasticity	CI
34.50 to 47.00	Very stiff hard, brown silty sandy, fine, medium gravely clay of low to intermediate plasticity	CLS-CIS-CLG-CIG (GWC)
47.00 to 51.00	Fine to medium grained high silty, sandy clayey gravel clay of intermediate plasticity	GC-CG

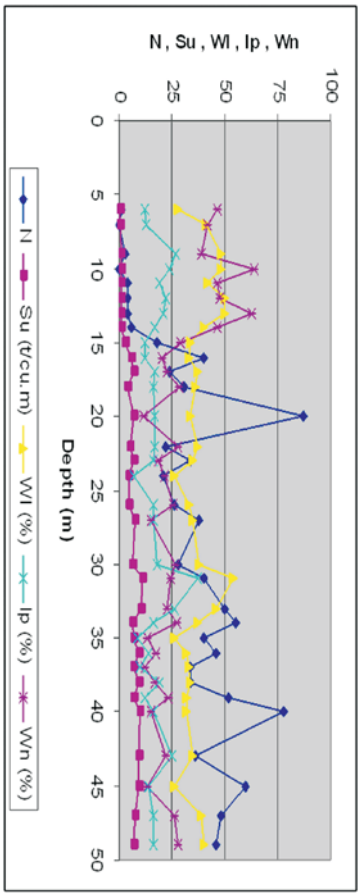

Figure - 4: Geo-technical Soil Profile

The over-consolidation ratio and undrained shear-strengths for soils at various depths are shown in Table-3. The results of Table-1 are used to calculate liquidity index (I_l) and over burden pressure (σ'_0). The over-consolidation ratios and undrained strengths are calculated on the basis of Wroth concept and correlation equations.

The over-consolidation ratio in Table-3 reveals that the soil is normally consolidated up to 14 m depth, and below that it is over-consolidated. Also, the soil near the surface is very soft clay, having low shear-strength.

THICKNESS OF SQUEEZE-OUT ZONE

To check the thickness of squeeze-out zone under the embankment, four different sections were chosen and the thickness of the squeeze-out zone was estimated

Table - 2(a): Section I: H_t = 8.5 + 1.5 = 10m, L = 15m, q = 2*1.5 + 1*8.5 = 11.5t

H (m)	C = S_u (t/m^2)	qh -4CH	2CL
0.5	0.08	6.60	2.40
1	0.2	10.70	6.00
2	0.45	19.40	13.50
2.5	0.62	22.55	17.60
3	0.80	25.00	24.00
3.5	0.90	26.60	27.00
4.5	1.10	32.00	33.00

Note: Required thickness of squeeze out zone found by interpolation = H ≅ 3.4m

Table - 2(b): Section II: H_t = 6.5 + 1.5 = 8m, L = 12m, q = 2*1.5 + 1*6.5 = 9.5t

H (m)	C = S_u (t/m^2)	qH -4CH	2CL
0.5	0.08	4.60	1.92
1	0.2	7.70	4.80
2	0.45	14.00	10.80
2.5	0.62	16.55	15.00
3	0.80	17.90	19.20
3.5	0.90	20.65	21.60
4.5	1.10	22.95	26.40

Note: Required thickness of squeeze-out zone found by interpolation = H ≅ 2.8m

Table - 2(c): Section III: H_t = 4.5 + 1.5 = 6m, L = 9m, q = 2*1.5 + 1*4.5 = 6.5t

H (m)	C = S_u (t/m^2)	qH -4CH	2CL
0.5	0.08	3.59	1.44
1	0.2	6.70	3.60
2	0.45	11.40	7.10
2.5	0.62	12.60	11.16
3	0.80	12.90	14.40
3.5	0.90	13.65	16.20
4.5	1.10	14.00	20.00

Note: Required thickness of squeeze-out zone found by interpolation = H ≅ 2.7m

Table - 2(d): Section IV: H_t = 2.5 + 1.5 = 4m, L = 6m, q = 2*1.5 + 1*2.5 = 5.5t

H (m)	C = S_u (t/m^2)	qH -4CH	2CL
0.5	0.08	2.59	0.96
1	0.2	4.70	2.40
2	0.45	6.40	5.40
2.5	0.62	6.55	6.44
3	0.80	6.90	9.60
3.5	0.90	6.65	10.80
4.5	1.10	4.95	13.20

Note: Required thickness of squeeze-out zone found by interpolation = H ≅ 2.50m

by using equation-4, while using average soil-strengths for each section (see the tabulated values as given in Table-2(a) to 2(d).

The above analysis for four typical sections of the embankment indicates that the soft soil near the surface (up to about 2.5 to 3 m depth) will fail in shear, due to load of the embankment and will squeeze-out.

SLOPE- STABILITY ANALYSIS

The slope-stability analysis (effective stress) was performed by using the well known slope-stability computer code 'STABL', which displayed factor-of-safety alongwith critical failure circle. The approximate shape of the critical failure circle, along with factor of safety is shown in Figure-5.

The stability analysis displayed a factor-of-safety as 1.76 and, hence, declares it safe for the given embankment load.

CONCLUSIONS

1. The soil which has natural moisture-content significantly less than the liquid limit is pre-consolidated.
2. Squeeze-out zone can be estimated before construction, by comparing active and passive forces.
3. Factor-of-safety against slope-failure can be calculated by using a software "STABL" for effective stress conditions.
4. Squeeze-out zone of 2.50 to 3 m depth was found by analysis and, nearly, the same value was observed practically when surcharge load was applied to the soil.
5. A factor-of-safety of 1.76 is displayed by the slope-

Table - 3: Over-consolidation Ratio and Undrained Shear-Strength

Depth	I_l	Over Burden	Pre-consolidation pressure	Over consolidation Ratio	Undrained shear strength
m	-	σ'_0	σ_c	OCR	S_u
-	-	t/m^3	t/m^3	-	t/m^3
6	-	2.52	NC	1	0.33
7	-	3.00	NC	1	0.48
9	0.67	4.20	NC	1	0.88
10	1.70	4.80	NC	1	0.95
11	1.25	5.40	NC	1	0.98
12	0.945	6.13	NC	1	1.17
13	1.60	6.86	NC	1	1.29
14	1.40	6.59	NC	1	1.31
15	0.61	7.50	25.50	3	3.16
16	0.00	9.50	63.00	6.63	5.96
17	0.15	10.50	56.00	5.33	6.92
18	0.52	11.54	31.50	2.73	4.36
20	0.00	13.62	63.00	4.63	7.02
22	0.48	15.70	34.50	2.20	5.10
23	0.00	16.74	63.00	3.76	7.17
24	0.39	16.85	39.50	2.20	4.56
26	0.53	20.21	30.50	1.51	4.75
27	0.00	21.40	63.00	2.94	7.60
30	0.38	25.00	40.00	1.60	6.43
31	0.20	26.10	51.80	1.98	11.25
33	0.10	27.30	57.60	2.10	10.56
34	0.38	29.40	39.50	1.34	6.30
35	0.00	30.50	63.00	2.07	6.82
36	0.00	31.60	63.00	2.07	9.15
37	0.00	32.70	63.00	1.93	7.13
38	0.10	33.80	57.00	1.72	9.40
39	0.26	34.90	46.50	1.36	6.90
40	0.00	36.00	63.00	1.75	9.76
43	0.48	39.30	-	-	-
45	0.00	41.50	63.00	1.52	9.32
47	0.19	43.70	51.50	1.18	7.44
49	0.25	46.00	47.00	1.04	7.03

stability analysis that shows it to be safe and stable under the load of the given embankment. Practically, no problem was observed, except for the occurrence of minor cracks in the existing road- surface adjacent to the embankment.

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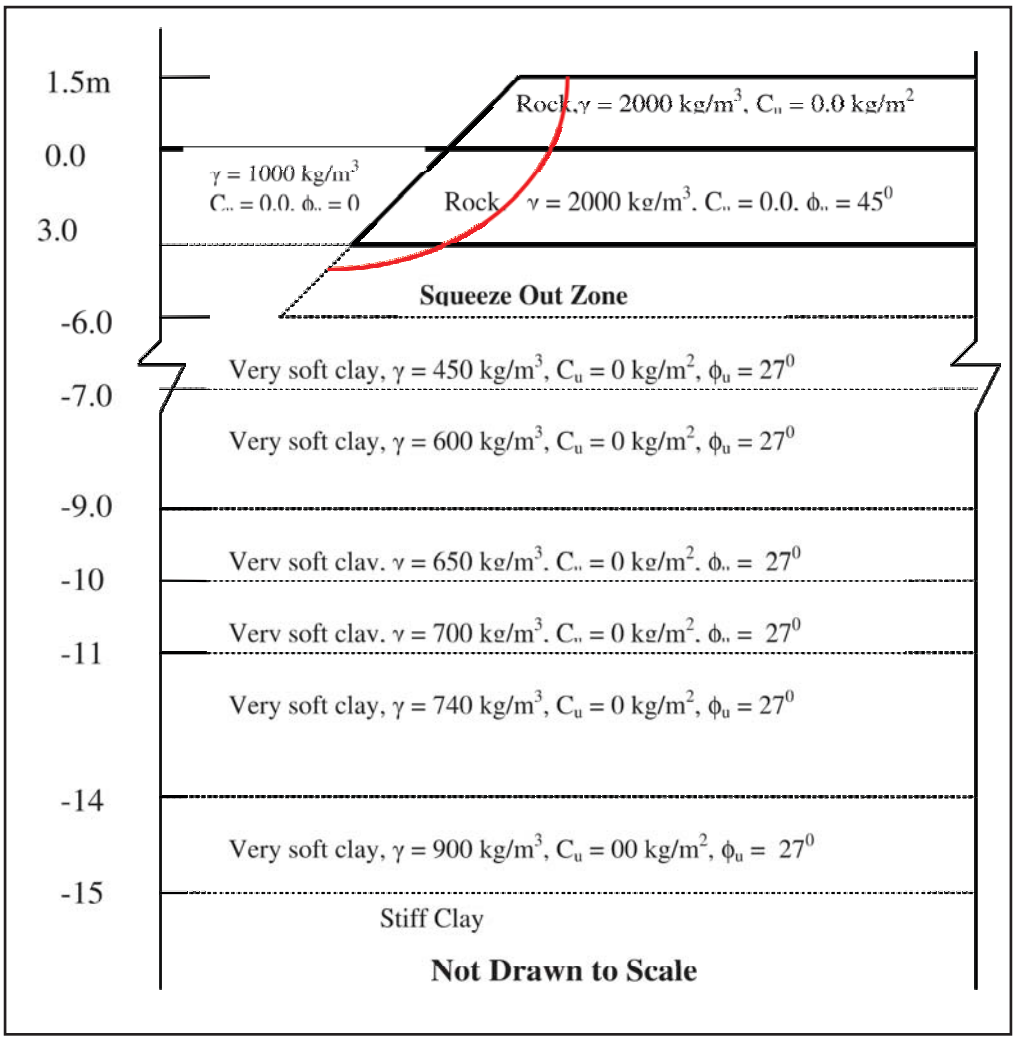

Radius of critical circle = 2.2m and factor of safety for critical circle = 1.76

Figure - 5: Slope-Stability Analysis (Effective Stress)

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