

# HUMAN RESOURCE REQUIREMENTS TO MEET THE CHALLENGES OF 21<sup>st</sup> CENTURY

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# Human Capital Development

In Engineering and Technology  
Leads to faster industrialization of  
India

# Knowledge Capital Development

- An outcome of human capital development
- Creates intellectual properties
- Impacts on the GDP and Indian economy
- Alleviates poverty
- Improves the market share of Indian Industry in global market place
- Creates global leaders in technology
- Helps them acquire industries from other countries

# **INDIA IS FAST becoming as one of the EMERGING LEADERS IN PRODUCTION AND SERVICES DUE TO GLOBALIZATION OF INDIAN ECONOMY**

- \* As human capital supplier to the WEST, EAST and the Pacific**
- \* As knowledge capital supplier to the MNCs**
- \* As supplier of quality engineering / software products and technical services**

# Problems of the West

- Shortage of human resources in engineering and technology to replace the retirees there
- Shortage of highly qualified scientists , technicians, managers , technologists and engineers to do further research
- Dependence on foreign students and research scholars from India, China and other countries
- Decline in the output of graduates in the US Universities and research products

# Competitive Strengths of South India

- Substantial private sector investment in technical education
- Location advantage based on geographic presence in the Indian economy
- Promising core industry clusters in high technology, manufacturing of automobiles , textile garments, leather goods , electrical goods and software development and B P O service .

# Investors

- Successful public-private initiatives in key industry clusters at state / national level
- Foreign Direct Investment in manufacturing industries and product design
- Expansion of Indian Industry in the southern and western region
- Establishment of new industrial corridors and hubs with foreign collaboration

# Engineering Education

- Renewed commitment and leadership on improving technical education and training outcomes
- Strong polytechnic colleges, engineering colleges and private technical universities / Deemed Universities, support of business associations, industry sectors, workforce development
- A set of national teacher training institutes to meet the quality needs of technical teachers



# Competitive Challenges

- Lack of integrated, region wide strategy for technical education, economic development, and work force development
- Low higher educational attainment
- Low educational investments
- Low research and development investments in engineering colleges and technical universities
- Low training investments

# Urgent Need

- Key to effective competition now are agility, fast response to market shifts, continuous innovation and focus on design and production
- Dynamic industry relevant curriculum development process
- Partnership with industries, government industries, national laboratories and entrepreneurs

# Gaps

- Available workers and technicians lack I T enabled skills and competencies
- Weak links between polytechnics and engineering colleges and industries
- Shortage of trained faculty
- Inflexible (rigid) curriculum
- Shortage infrastructure and resources

# Demand

- Business growth
- Advancing technology
- Demand for Innovative multi-skilled and interdisciplinary workforce
- Higher skills and competencies in analysis, design, manufacturing and maintenance
- Joint evaluation, cooperative planning of curricula and implementation

# Opportunities

- Growth of business and industry clusters that have multiplier effects, pay high wage jobs and other benefits
- Demand for highly skilled workers who can meet needs of industries in the corridor and can compete in the national and global economy
- Demand for seamless workforce system and stay marketable in the job world

# Scenario of India ( 12<sup>th</sup> Five year plans) {2012-2017}

- GDP to Double to \$2.5 trillion?
- Global meltdown ?
- Export US \$155 to 200 billion ?
- One more year of tax holiday for E o Us
- Concessional export credit for high employment generating sectors
- 6,50,00,000 more jobs in the formal job market
- 6,00,00,000 more jobs are expected to be created by the country's booming economy

# Issues that can pull down the growth

- Global meltdown
- Shortage of funds for investment
- Shortage of electric power
- Ever increasing of non-plan expenditure
- Retardation in global markets
- Fall in market demands
- Rapid growth in unemployment

# Shortage of ...

- Multi-skilled workers
- Multidisciplinary technicians
- Highly qualified teachers
- Strategic vision for growth
- Infrastructure and resources
- Dynamic industrial policy too !



# Extrapolation ...

- Every \$ 1 billion of incremental export would create 226000 new jobs
- Export target US \$ 200 billion for 2013-14
- Possible amount US \$ 155 billion
- S E Zs are emerging as engines of export growth
- E o Us can enjoy tax holiday till 2015

# Outsourcing for Production and Services

- Looking for countries with trained human resources in science, engineering, technology, management and human resource development
- Participants of Global economy through WTO
- Climate for developing the products and services
- Local high purchasing power for goods and services and paying fees to colleges
- Capability for undertaking the research and development works

# Key Factors

- Excellence in technical education
- Engineers and Technicians with strong analytical skills
- Managers with multicultural understanding who can perform in a global context
- Scientists with intellectual agility

# GLOBAL COMPETITIVENESS IN AUTOMOBILE MANUFACTURING TECHNOLOGY

- Ashok Leyland with Renault partnership
- Hyundai
- Hero motors and Daimler partnership
- BMW
- FORD
- Caterpillar
- Mitsubishi
- Nissan & Renault
- TAFE
- GM

# Industry – Endorsed Competence Assurance Framework

- Demonstrating leadership and commitment
- Identifying industry critical activities
- Setting procedures and global standards
- Competence against the standards
- Taking action to improve competence
- Commitment to continuous improvement

# Computer and Electronic Industries

- DELL
- VIDEOCON
- FLEXTRONICS
- SAMSUNG
- MOTOROLA
- IBM

# Attractions to Foreign Direct Investment (FDI)

- Quality technical manpower
- Knowledge of English
- Fast growing middle class
- Economical growth
- 6 % Growth in GROSS DOMESTIC PRODUCT (GDP)
- Focus on infrastructure development
- Good climate
- TAX CONCESSIONS

# How will India create Centers of Excellence?

- Leadership of faculty
- Innovation of industries
- Delegation of college administrators / managers / leaders
- Commitment for excellence of UGC / AICTE / SBTE ?
- Strategic planning of Universities /Colleges



# Human Resource Development

- Multi-disciplinary long-term programs
- Flexible programs
- Short-term modular programs
- MOOCs
- Industrial training / internship
- Technical working group meetings
- Development workshops
- In-house programs
- Life-long education

# Estimation of Trained Human Resources Required in 2020

- 6,50,0000 Multi skilled workers
- 6,00,0000 Competent IT enabled technicians, applied scientists, engineers and managers
- Research and development engineers
- Managers with exposure to international business practices
- Applied scientists

# Industrial Collaboration through Partnership

- Starting I T I s, Polytechnics, Engineering Colleges, Technical Universities through industrial cooperation through P-P-P
- Sponsoring research and development programs
- Funding for proto type development
- Joint evaluation of existing curricula by industries
- Participation in preparing goals, objectives of professional programs
- Cooperation in implementation through training

# Need for Frontal Assault

- Institutional autonomy with accountability
- Accreditation of programs by industry and ABET
- Programs for institutional development and creation of centers of excellence
- Programs and projects to meet the growing technology and economy
- P-P-P for expansion of institutions

# Learner Skills Development

- Competency development
- Complex problem solving skills
- Risk taking skills
- Leadership
- Design skills
- Product development skills
- Manufacturing skills
- Total Quality Management
- Maintenance skills

# Transformation Process in Technical / HRD Education

- Industry specific/ relevant flexible curriculum
- Industry based/ sponsored projects
- Industry specific/ sponsored research work
- Cooperative programs
- Networking with industries and global institutions
- Industrial training and optional internship
- Global Human Resource Management /  
Development programs

# Formation Technical Working groups at State / University Level

- Regional Joint Director / Dean Academic as chairman
- Principals of government, state aided and private self financing polytechnics and engineering colleges
- Heads of departments & Industry representatives
- Experts from the higher education institutes and national laboratories

# External Assessment

- A meeting with state level organizations like ASSOCHAM, CII and FICCI
- Understanding the needed competencies
- Planning for updated programs
- Developing industry relevant draft programs
- Validating and Implementing them



# Create Centers of Excellence

- Develop Technical / HRD &M Education Programs to meet Global Standards
- Provide Academic Autonomy with built in Accountability
- Develop Market Driven Flexible Programs
- Network with national laboratories, MNCs and international institutions

# What are the current problems in developing human resources?

- Institutional development
- Lack of Industry Institute Community Partnership
- Heavy control of various councils
- Corruption
- Lack of Vision
- Faculty shortages
- Lack of development programs
- Lack of funds

# Credit based Flexible Programs

- Programs are to be based on the industrial relevance
- Basic, Core, Applied, Advanced, Electives,
- Independent Studies
- Country specific programs and courses
- Total credits are to be fixed but duration varies, maximum five years for graduate programs
- Two to five years for post graduate programs

# Flexibility

- Learners plan their courses based on their career needs / vision /goals
- University could offer the courses demanded
- Net worked programs
- Hybrid programs (MOOC and f2f)
- Responds to the client needs

# Credit Transfer

- Based on the objectives and outcome oriented courses
- Built in Standards
- Reasonable number of credits
- Based on ABET accreditation
- Country specific courses
- Joint evaluation of courses

# **Region-wide Innovation Corridor Workforce Initiatives**

- **Workforce development to meet the demands**
- **Formation of innovation corridor**
- **Consortium of industry and technical education institutes**
- **Creation of the next generation of innovators (engineers, managers and technicians)**
- **Capitalization of wealth of research and development utilization of manufacturing assets**
- **Work force transformation through cooperative engineering programmes**

# Innovation Corridors

- Bangalore – Mysore Industrial Corridor
- Bangalore- Mumbai Industrial Corridor
- Bangalore-Hosur- Chennai Corridor
- Delhi-Mumbai Industrial Corridor
- Chennai – Trichy Industrial Corridor
- Chennai – Ennore- Industrial Corridor
- Chennai- Nellore-Vizag Industrial Corridor

# Strategic Goals

- **Sustainable Entrepreneurship**
- **Manufacturing value chain and supplier competitiveness**
- **Development of innovation-oriented technical support**
- **Industry Participation in Technical Education Planning and Implimentation**



# Global Competition

- **National challenge**
- **Frontlines of the battle are regional**
- **Competitive Advantages for Companies through technicians, engineers, technical institutions, researchers, government and entrepreneurs**
- **All come together to create competitive advantage.**

## **Ability to Transform**

- **New ideas and new knowledge into advanced, high quality products and services.**

# Elements to Accelerate the Process

- Workforce skill-building
- Problem based learning
- Problem solving skills
- Creative design skills
- Lifelong learning strategies
- Investment and entrepreneurial strategies
- Regional and economical development strategies.

# Innovation Support

- **Meet the demands of the global companies in the region/ corridor**
- **Develop highly skilled technicians, engineers and managers**
- **Develop 21<sup>st</sup> century job profiles to define future workforce skills and needs**
- **Compilation of an innovation asset inventory to foster innovation and entrepreneurship.**

# **Improve the International Competitiveness of the Southern and Western regions of India**

- **Develop and execute a smart supplier strategy**
- **Support global manufacturers and small and medium entrepreneurs**
- **Adapt to the global manufacturing transformation.**

# Industrialization

- **Improve the international competitiveness of the region's supply chain by developing and executing a smart supplier strategy**
- **Adapt to the global manufacturing standards**
- **Identify the competencies needed**
- **Invite collaboration of the manufacturers**
- **Develop industry driven manufacturing technician training programmes.**

# Career Opportunities

- **Strategic and integrative role in the effective operation of business enterprises**
- **Manufacturing industries**
- **Service and commercial enterprises**
- **Management consulting firms**
- **Public / private sector industries**
- **Software industries**
- **Manufacturing consumer goods**
- **Ancillary products**
- **Maintenance engineering**
- **Energy management.**

# Part -I



# Career Opportunities in Civil Engineering

- Urban reconstruction
- Building technology and management
- Infrastructure development
- Construction technology / management
- Transportation engineering (Highways / Airports / Ports and Harbor construction)
- Real Estate Management
- Industrial Structures and Parks
- Environmental and Sustainable Development
- Pollution Control
- Private Builders
- Housing complexes satellite towns

# Career Opportunities in Electrical Engineering

- State Electricity Boards
- Power Generation and Distribution
- Power Corporations
- Electrical machinery manufacturers
- Manufacturing industries
- Alternate energy producers
- Electrical service industries
- Consultancy firms
- Maintenance firms
- Marketing and maintenance
- Telecommunications service.

# Nature of Employment

- **Product Design**
- **Prototyping**
- **Manufacturing**
- **Testing**
- **Installation**
- **Operation**
- **Maintenance**
- **Planning**
- **Management.**

# Career Opportunities in Mechanical Engineering

- Manufacturing sector
- Automobiles
- Consumer goods
- Heavy machinery
- Precision components
- Electrical households appliances
- Electronics products
- Maintenance.

# Nature of Employment

- Design
- Prototype development
- Installation
- Commissioning
- Maintenance.

# **Jobs in Electronic Engineering**

- **Manufacturing of computer hardware and instruments**
- **Control systems, computers, Satellite communication systems**
- **Wireless Networking and Maintenance**
- **Spare utility companies**
- **Industrial electronics**
- **Service industries**
- **Electronic data systems.**

# Nature of Employment

- Research, design and development
- Installation, operation and maintenance
- Utility services planning
- Design of defense related products
- Industrial products planning
- Consultancy works
- Manufacturing of electronic goods related to TV's, Satellites, radars, wireless equipment
- System analysis and planning.

# **Industrial Management and Manufacturing Systems Engineering**

- **Strategic and integrative role in the effective operation of manufacturing industries**
- **Problem solving**
- **Innovations**
- **Coordination**
- **System integration.**



# **Jobs in Manufacturing Industries**

- **Manufacturing corporations**
- **Research and product development**
- **Service and commercial enterprises**
- **Management and consulting firms**
- **Management systems for business enterprises, MNCs**
- **Managing technical systems**
- **Energy management systems**
- **Building service systems**
- **Air Conditioning.**

# **Jobs in Environmental Engineering**

- **Careers in water, air, and noise pollution control**
- **Solid and hazardous waste treatment**
- **Clean technology**
- **Installation and maintenance of pollution control equipment**
- **Environment planning and assessment**
- **Impact studies.**

# Human Resource Development

- Long-term programs in global HRM / HRD
- Executive development programs
- HRIS
- Online programs
- In-house programs
- MOOC and f2f

# Industry Specific Courses

- Hands-on laboratory courses that focus on current issues in the application of engineering principles
- Prepare students for industrial needs assessment, prototype design and production work.

# **Accreditation of Programs by Industries**

- **Based on an Professional competencies of students and their achievements**
- **Outcome orientation**
- **Program objectives**
- **Faculty competencies**
- **Facilities / infrastructure**
- **Institutional commitment to total quality and ethics.**

# Trends in Employment of Biomedical Engineers

- Greater focus on health issues will drive demand for better medical devices
- Demand for more sophisticated medical equipment and procedures
- An increased concern for cost-effectiveness
- Rapid growth of pharmaceutical manufacturing industries.
- Generates the need for Biomedical Engineers

# Job Opportunities for Civil Engineers

- Housing for middle class
- Urban reconstruction
- Infrastructure development
- SEZ (Special Economic Zones)
- Software industrial parks
- High capacity transportation
- Replacement of existing roads, bridges, and public structures
- Real estate development
- Construction technology
- Service sector
- Maintenance.

# **Computer Hardware Engineers**

- **Computer & Semiconductor manufacturing**
- **Computer systems design.**



# Electrical Engineers

- Production of electrical machines, generators, transformers, motors
- Replacement of engineers
- Power generation
- Transmission
- Maintenance.

# Electronic Engineers

- **Rising demand for electronic goods**
- **Advanced communication equipment**
- **Defense-related electronic equipment**
- **Medical electronics**
- **Consumer products**
- **Service and maintenance**
- **Industrial electronics.**
- **Wireless technology**
- **Embedded system**

# Environmental Engineers

- Develop methods of cleaning up existing hazards
- Pollution control devices
- Pollution free technology (clean technology)
- Impact studies.

# **Safety Engineers**

- **Safe production**
- **Health and safety within work environments**
- **Product safety.**

# **Needs of the Technician and Degree Programs**

- **Revision**
- **Improvement**
- **Innovation**
- **Industry specific programmes**
- **Multidisciplinary programmes**
- **Flexible programmes**
- **Multi skilled programmes**
- **Cooperative programmes.**

# Industry-Institute-Partnership

- M o U s with consortium of industries
- M o U s with Consortium of Institutes
- Networking
- Joint planning of needs assessment
- Needs analysis
- Resource sharing
- Knowledge sharing

# Advisory Committees

- Members drawn from the consortium of industries, institutes, and higher education institutes, national institutes and national laboratories
- Generating the program goals
- Stating the objectives of courses
- Selecting the instructional processes
- Providing industrial exposures and training

# Joint Program Planning

- Program goals
- Program objectives
- Basic courses
- Applied courses
- Advanced courses
- Courses in technology , human resource management and financial management
- Electives / Industry specific electives (Jointly offered / out sourced / net worked )



# Joint Formative Evaluation

- Check the course objectives against the performance standards.
- Check the contents of the courses against the current industrial / professional practices
- Check the adequacy of the courses
- Check the analytical ,design, estimation, field work,practical,workshop / laboratory works

# Periodical Revision and Improvement

- Revise and update the curriculum periodically
- Assess the resources, infrastructure, funds, faculty competencies ,and other relevant requirements
- Check the instructional materials and aids
- Suggest improvements
- Carry out all accepted changes.

# Mass Production of Resources

- Train the project faculty / staff
- Implement the program in all institutions
- Evaluate the outcome
- Obtain the feedback from the faculty, participants, and industries.
- Analyze
- Revise and update

# Periodical Evaluation

- Evaluate the curriculum and instruction periodically
- Update the same
- Evaluate the policy of the government (Freezing of non-plan expenditure from 2004)
- ALLOT ADDITIONAL FUNDS

# Best and Brightest

- Create a climate for Excellence
- Undertake Industry Sponsored Research and Development Works
- Recruit, and retain brightest students, faculty and staff
- Eradicate corruption in recruitment

# Sustain the Development

- Human capital
- Knowledge capital
- Support institutional development
- Network with industries for research and development
- Create knowledge based society
- Decentralize educational administration

Bring continuous improvement  
in program planning and implementation  
through networking and globalization

# Update National Policy on Education



*Journey Always Continues !  
Never Ends !!*

Initiate globalization in  
engineering education

Thank you ,  
we hope that you will support all  
International educational  
Program planners, and human  
and knowledge capital developers