

# **TRANSFORMING INDIAN TVET PROGRAMS FOR INDUSTRY-4.0.**

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# CHALLENGES TO VOCATIONAL EDUCATION

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## VOCATIONAL EDUCATION



## SKILLS AND COGNITIVE TALENTS



# **CHALLENGES TO TECHNICAL AND VOCATIONAL EDUCATION**


- **What is the role of employers in developing vocational programs and ensuring the skill development that are needed in the modern work place under Industry-4.0?**
- **How will you ensure the graduates with generic, transferable skills to occupational mobility and lifelong learning, and with occupationally specific skills that meet employers' needs?**
- **What is the role of the employers in sharing the cost of vocational education under Industry-4.0.**
- **How will you plan and implement workplace training to meet the needs of employers and as well as that of the students?**



# SWOT ANALYSIS OF INDIAN VOC. EDN.

- **Strengths:**


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- Economy is growing due to FDI, FII, and WTO under globalized Indian economy.
  - The need for **multiskilled vocational graduates** increases under Make in India Scheme and Industry-4.0.
  - Fast growing industrial corridors and hubs attract many MNCs.
  - Focus on vocational education in all educational programs by NEP 2019.
  - ITI s and Polytechnics supply needed skilled workers to industries.
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# SWOT ANALYSIS...

- **Weaknesses:**

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- **Vocational Education in India has yet to create an impact on the human capital**
  - **Lacks industrial links**
  - **Work-based skill development has to improve**
  - **Vocational teachers need industrial exposure and training**
  - **Curriculum needs to be evaluated and improved in collaboration with employers**
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# SWOT ANALYSIS...

## Opportunities:


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- **Under globalized economy, more multiskilled workers are needed**
- **Demand for new innovative products increases in India**
- **Government Target: 5 trillion \$ Indian Economy**
- **New Industrial Corridors: Delhi- Mumbai- Bangalore- Chennai- Vizag- Kolkata, Chennai-Coimbatore, North East Corridor**
- **Make in India**

# SWOT ANALYSIS...

- **Threats:**

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- **Fast growing economy in East Asian Countries would become as serious competitors**
  - **ROI on obsolete vocational courses will be minimum**
  - **Improperly prepared vocational courses without collaboration with industries will not create human capital**
  - **Industry-4 demands cognitive skills and contextual knowledge**
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# CRUCIAL SKILLS THAT WILL BE NEEDED TO FACE THE INDUSTRY-4.0. REVOLUTION

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- **Virtual Collaboration:** The ability to effectively collaborate between virtual team members via digital technology
- **Cognitive Information Management:** The ability to effectively filter information and maximize cognitive functions.
- **Design Mindset:** The ability to represent and develop tasks and to focus on the work process to achieve the desired outcomes.

# CRUCIAL SKILLS...

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- **Social Intelligence:** The ability to convey concepts to others deeply and directly and be able to sense and stimulate reactions.
- **Adoptive Thinking:** Demonstrating the proficiency of thinking and coming up with solutions, and the ability to determine the deeper meaning of what's being expressed.

# TVET PROGRAMS FOR INDIAN ECONOMIC COMPETITIVENESS

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- **Global Economic Competition** increasingly requires India to compete on the quality of goods and services.
- This requires a human resource with a range of midlevel trade, technical and professional skills alongside the high-level skills associated with engineering education.
- Strains in existing vocational systems include lack of workplace training places and trainers.

# **DEMAND FOR A BROAD RANGE OF SKILLS IN TVET PROGRAMS**

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- **Indian Employers are ready to recruit ITI Graduates since they are industry ready**
- **Indian Vocational Education Programs are to be redesigned to meet the needs of Industry-4.0.**
- **A high-skilled labor force shall attract Foreign Direct Investment in India, and increase economic growth.**
- **Well designed and validated vocational programs can pay off in the labor market and good Return on Investment (RoI).**

# **STRENGTHEN LINKS BETWEEN TVET INSTITUTIONS AND INDUSTRY**

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- **TVET Institutions are to be linked with industry**
- **In deregulated markets employers shall recruit multiskilled vocational graduates, train them and retain the most productive as long-term employees.**
- **Micro and medium-sized enterprises shall recruit well trained multiskilled vocational graduates.**
- **There is a need for policy for apprenticeship training of the vocational graduates in new industries.**

# **INDUSTRY- 4.0.**

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- **Virtually every Indian industry is being impacted by the disruptive power of digital technology which has been quietly ushering in the Fourth Industrial Revolution across the Globe.**
  - **Educational Administrators and Leaders are focusing on the mass changes as they look for ways to develop new Vocational, Technician and Engineering Programs to take advantage of the opportunities that arise from the emergence of Industry- 4.0.**
  - **Industry- 4.0 considers the current trend of automation and data exchange in manufacturing technologies.**
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# APPLICATION OF INDUSTRY-4.0.



# INDUSTRY-4.0.

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- Includes Cyber-Physical Systems,
- Internet of Things (IoT),
- Cloud Computing, and
- Cognitive Computing.



# ADVANTAGES OF INDUSTRY-4.0.

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- Fast
- Flexible
- High Quality
- Efficient Production System

# MANUFACTURING UNDER INDUSTRY-4.0



# THE NEXT PHASE IN THE DIGITIZATION OF THE MANUFACTURING SECTOR IN INDIA

- **Industry-4.0 is being driven by Four Disruptions:**

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- **The rise in data volumes**, computational power and connectivity
- **The emergence of analytics** and business intelligence capabilities
- **New forms of human-machine interaction**, such as touch interfaces and augmented reality systems, and
- **Improvements in transferring digital instructions** to the physical world, such as **Advanced Robotics** and **3D Printing**.



# INDUSTRY-4.0



# NEEDED PREPARATION OF INDIAN TVET TRAINERS

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- **Should link with National Institutes of Technology, State Technical Universities, Polytechnic Colleges, Pandit Sunderlal Sharma Central Institute of Vocational Education ( PSSCIVE), Vocational Schools,**
- **Industrial Training Institutes and National Technical Teacher Training Institutes and Research**

# CRUCIAL SKILLS NEEDED TO FACE THE INDUSTRY-4.0.

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- Virtual Collaboration
- Cognitive Load Management
- Computational Thinking

# NEED FOR DIGITALLY SKILLED WORKERS IN INDUSTRY-4.0



# FORCES SHAPING DIGITAL FUTURE

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- **Acceleration**
- **Convergence**
- **Individualization**



# TRENDS IN INDUSTRY-4.0

- **Connects digital technologies with industrial processes, products, and logistics**
- **Industrial Automation: Device connectivity, robotics, and data exchange in the manufacturing environment**
- **Top trends in Industry-4: 1. Predictive Maintenance/condition Monitoring**
- **2. Augmented Reality (AR) and Virtual Reality (VR)**
- **3. HMI (Human Machine Interface)**
- **4. Artificial Intelligence**

# CURRENT REFORMS IN KOREA

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- **National Competencies Standards : TVET System provides skills that are linked to labor market needs**
- **College of Lifelong Learning Programs**
- **Work first, College Later Programs**
- **Learning Voucher Programs**
- **Employment Success Package**
- **Specialized Vocational High School (Meister High School)**

# CHALLENGES TO REPUBLIC OF KOREA

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- **Increasing youth unemployment rate**
- **Differences of working conditions between large enterprises and SMEs**
- **Rapid development of science and technologies**
- **Ageing society**
- **Free semester system for career education**

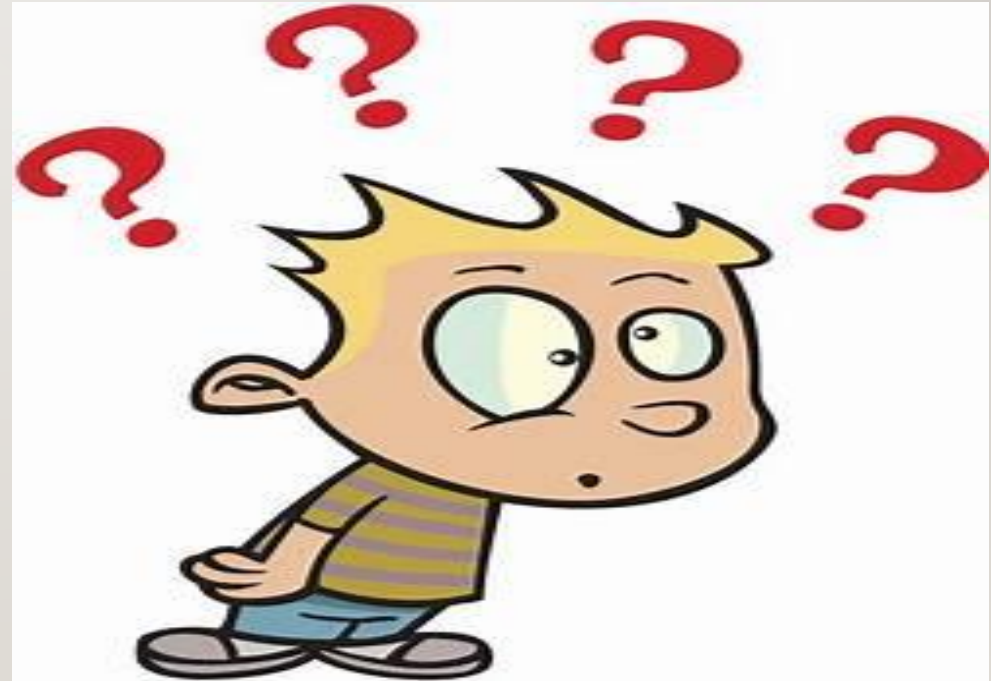
# CAREER OPTIONS IN VOCATIONAL EDUCATION

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CONFUSED VOCATIONAL STUDENT



WHICH WAY TO GO?



# LEARNING SYSTEMS FOR INDUSTRY- 4.0

- **Learning systems are to be equipped with innovative industrial technologies so that knowledge required for digital production can be imparted in a practical manner, which simultaneously developing through hands- on trial and error. This approach should include:**
- **Cyber–Physical Systems, RFID and NFC technologies**
- **Intelligent Vertical and Horizontal Networking,**


# LEARNING SYSTEMS FOR INDUSTRY- 4.0 ...

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- **Plug and Produce**
- **Monitoring of System States and Energy Consumption**
- **Mobile Robotics**

# LEADERSHIP- 4.0

- **Management Capabilities** needed to support the pace of change of Industry-4.0
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- **Competition:** Spot and react quickly to new competition on the horizon
  - **Hierarchy:** Needs to free up the decision making process to maximize opportunities, while keeping clear communication flowing throughout the organization
  - **Technology:** Harness the talents of individuals who can fully explore, utilize and maximize new technological advancements
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# THE FEATURES OF THE PRODUCTION UNDER INDUSTRY-4.0.

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- **Entire production plants will be digitally networked:**
  - **The plant has a virtual emulation which will enable automatic start-up and reconfiguration**
  - **Rapid balancing of capacity utilization in a production network**
  - **Automatic adaptation of production lines to ordering capacities through simple, rapid extension or reduction of the manufacturing facilities**
  - **Simple compensation for defective production units**



# THE FEATURES OF THE PRODUCTION UNDER INDUSTRY-4.0. ...

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- **Control of Production is being more Intelligent and Adaptable**
- **Automatic Start-up and Reconfiguration of Facilities**
- **Customer Specific Production**
- **Humans and Technologies are Cooperating to an Increasing Extent**

# PREPARATIONS FOR THE SMART FACTORY

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- **The use of mobile terminal devices, such as tablets and smart phones, in production**
- **Planning and organization for networking of intelligent system components and modules**
- **Integration of facilities into ERP systems**
- **Vertical networking of production sites through out the value added chain via the virtual world of the Internet.**

# ROLE OF EMPLOYEES

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- **Employees play an important role as problem solvers, experienced experts, and decision makers within the manufacturing networks that consist of virtual and mechatronic production sequences.**
- **They will remain irreplaceable in the future as idea generators, and developers of new products and work processors, enabling their capacities and skills to continuously evolve into an essential resource.**

# PROVIDE RIGHT MIX OF SKILLS FOR THE INDIAN MARKET

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- **In the 21<sup>st</sup> century, those entering the labor market need immediate job skills, but they also need the career and cognitive competencies to handle different jobs and to sustain their learning capacity.**
- **Many skills requirements are volatile and driven by rapid technological advances has increased the demand for higher level technical skills, including at graduate level.**

# REFORM THE CAREER GUIDANCE

- **Develop a coherent career guidance focused on the career opportunities**
- **Offer adequate resources for career guidance and its pro-active delivery**
- **Ensure an independent base to support objective career guidance**
- **Provide good sources of information about careers and programs**

# REFORM THE CAREER GUIDANCE...

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- **Build a comprehensive framework of guidance through partnership with employers**
- **Evaluate the career guidance**

# TRAIN THE INSTRUCTORS, FACULTY MEMBERS AND TRAINERS

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- **Recruit sufficient instructors and trainers for TVET institutions and ensure that this team is well-acquainted with the needs on Industry-4.0.**
- **Provide needed workplace learning and training.**
- **Ensure flexible pathways of recruitment and encourage them to join the TEVT Institutions.**
- **Provide appropriate andragogical training and encourage supervisors, trainees and interns to learn on the jobs.**

# PROVIDE WORKPLACE LEARNING AND TRAINING


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- **Plan substantial workplace learning and training**
- **Encourage the participation of the employers representatives**
- **Ensure quality assurance**
- **Develop clear contractual framework with evaluation of skill development**
- **Simulate and sustain workplace training**



# ENGAGE STAKEHOLDERS

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- **Engage employers in TVET Policy and provisions through effective mechanisms**
  - **Engage all stakeholders to develop and implement qualification frameworks coupled with quality assurance**
  - **Develop standardized national assessment frameworks to underpin quality and consistency in training provision**
  - **Collect data on labor market outcomes of TVET**
  - **Analyze and prepare reports and disseminate**
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# EVALUATE THE EXISTING TVET PROGRAMS

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- **Evaluate the existing TVET Programs against the needs of Industry-4.0.**
- **Design needed new TVET Programs in collaboration with the employers**
- **Develop Program Educational Objectives based on the needs of the industry**
- **Formulate the desirable course outcomes to meet the tasks**
- **Conduct formative evaluation and improve the curriculum**

# ESTABLISH NEW TVET PROGRAMS IN THE INDUSTRIAL HUBS AND CORRIDORS

- **Adopt Public Private Partnership Model in establishing the TVET Institutions.**
- **The Professional Associations like CII, FICCY, NASSCOM, SIAM, etc. participate in all phases of planning, implementing, training and evaluation.**
- **Conduct summative evaluation**
- **Periodically conduct tracer/ longitudinal studies**
- **Ensure continuous transformation in teaching, learning, skill development, and internships.**

# CHALLENGES TO TVET INSTITUTES IN INDIA

- **Have you developed new TVET Programs in collaboration with the employers?**
- **Have you planned industrial work- based learning and skill development?**
- **Have you designed the blended learning?**
- **Have to linked all the TVET Institutions with the industry?**
- **Are you periodically conduct tracer studies?**
- **Are you planning new innovative industry specific TVET programs?**

# STRENGTHS OF KOREA'S TVET SYSTEM

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- **Strong Employer involvement in TVET policy development and implementation**
- **The tertiary TVET sector is well developed**
- **Around 32% of tertiary students are enrolled in junior colleges and polytechnic colleges.**

# STRENGTHS OF TVET SYSTEM IN CHINA

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- **Upper secondary vocational education provides a range of specialisms, a good percentage of general academic skills underpinning all the programs, and a commitment to workplace training and close relationships with employers.**
- **Teachers in vocational schools are required to spend one month in industry every year**
- **Many schools employ a significant number of part-time teachers from industry.**

# STRENGTHS OF TVET SYSTEM IN GERMANY

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- **German system offers qualifications in a broad spectrum of professions and flexibility adapts to the changing needs of labor market.**
- **The dual system integrates work-based and school-based learning to prepare apprentices for a successful transition to fulltime- employment.**
- **The TVET system as whole well-resourced.**
- **Federal Institute for TVET and a National Network of Research Centers conduct research studies and support continuous innovation and improvement in the TVET System.**

# STRENGTHS OF TVET SYSTEM IN SWITZERLAND

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- **The system is strongly employer and market driven**
- **The partnership between Confederation, Cantons and Professional Organizations works well.**
- **School and work-based learning are well integrated.**
- **System is well- resourced able to modernize with up to date equipment**
- **Flexible pathways have been introduced to allow for mobility and avoid the risk of dead-ends.**
- **Quality control is ensured and national assessment procedures are in place.**



## POLICY DIRECTIONS FROM NEP 2019

- **Objective: Integrate vocational education into all educational institutions.**
- **Provide access to vocational education to at least 50% of all learners by 2025 (p-357).**
- **Broad definition of vocational education would include professional education as well.**
- **Vocational education should integrate not just hands on skilling component but also the theoretical knowledge, attitudes and mindsets, and soft skills that are required for particular occupations, through broad-based education.**

# FRESH APPROACH TO VOCATIONAL EDUCATION (NEP 2019)

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- **Implementation of vocational education should be improved.**
- **Recruit Teachers, Develop Infrastructure and Industry Specific Curriculum.**
- **Vocational education must be fully integrated within main stream of education.**
- **A NATIONAL COMMITTEE FOR THE INTEGRATION OF VOCATIONAL EDUCATION (NCIVE) WILL BE SET UP.**
- **Academia have to work closely with standards bodies within industry and with potential employers, so that graduates have adequate employment opportunities.**

# VOCATIONAL JOBS NEED SKILLS AND COGNITIVE TALENTS



# SUGGESTIONS FROM NEP 2019

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- **Collaborate with National Institutes of Technical Teachers Training and Research, ITIs, Polytechnics, local industries and businesses, etc.**
- **Work with NCERT through the Pandit Sunderlal Sharma Central Institute of Vocational Education and with SCERTs**
- **Induct external experts in different vocations**
- **Train the teachers to offer vocational education**
- **Conduct assessments of all vocational education courses, jointly with partners that are providing the practical skills training.**

# **SUGGESTION FROM NEP 2019 FOR VOCATIONAL EDUCATION CURRICULUM DEVELOPMENT (NEP)**

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- **Work with NCERT through Pandit Sunderlal Sharma Central Institute of Vocational Education (PSSCIVE) and with SCERTs through State Institutes of Vocational Education where they exist) to create curriculum and supplementary educational material for vocational education that are adopted to local needs.**
- **National Committee for the Integration of Vocation of Vocational Education (NCIVE) will need to create a plan for this in collaboration with all stakeholders.**

# INTEGRATING VOCATIONAL EDUCATION INTO ALL SCHOOLS, COLLEGES AND UNIVERSITIES (NEP)

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- **Ministry of Skill Development and Entrepreneurship (MSDE), MHRD, and all other ministries of the Central and State governments engaged in vocational education.**
- **National Skills Development Agency (NSDA), National Council for Vocational Education and Training (NCVET), State Skill Development Mission (SSDMs), Sector Skill Councils (SSCs) financial institutions and others;**
- **Implementing bodies such as ITIs, Polytechnics, Industries, businesses and other training providers,**
- **Schools, Colleges, and Universities ,**
- **The beneficiaries themselves, youth and adults.**

# DATA GATHERING, MIS AND TECHNOLOGY SUPPORT FOR THE ROLLOUT OF VOCATIONAL EDUCATION (NEP)

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- **NCVET will host a Labour Market Information System**
- **Track certified candidates, courses, training providers, trainers, assessors**
- **Gather data for determining the types and nature of courses that will be required in particular geographies**
- **MIS for data on successful courses conducted by all the institutions in various sectors of the economy**
- **Technology platforms for training of the teachers and end to end delivery of vocational education**
- **NCIVE will develop a plan for collection and analysis.**

# **NATIONAL SKILLS QUALIFICATIONS FRAMEWORK (NSQF) (NEP)**

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- **The generic competencies defined at each of the 10 levels by the umbrella framework of the NSQF will be translated into specifics for each of the disciplines/ vocations/ professions in different sectors.**
- **Course content and assessment criteria, and appropriate curricular and assessment frameworks will be standardized by academic institutions with other stakeholders aligned to these levels.**



# **NATIONAL OCCUPATIONAL STANDARDS AND INTERNATIONAL COMPATIBILITY OF STANDARDS**

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- **Indian standards must be aligned with International Standard Classification of Occupations (ISCO) which is maintained by the International Labour Organization (ILO)**
- **The Qualification Packs-National Occupational Standards (QPs-NOS) must be aligned with international standards.**
- **Employers have to specify the most appropriate standards for each of the job roles within their organization and educators can train to the same standards.**

# **NATIONAL QUALIFICATION REGISTER (NQR)**

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- **NQR is designed to be the official national public record of all qualifications aligned to the NSQF.**
- **Educational institutions offering an NSQF-aligned qualification can enter details of their training programs on the NQR portal that can be used by other institutions.**

# **STRENGTHENING PSSCIVE AND STATE LEVEL INFRASTRUCTURE**

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- **PSSCIVE and state level institutions shall need considerable strengthening, through heavy investments in human resources and infrastructure, including technology, so that it is able to play the major role that it has in proliferating vocational education.**

# **WORK INTEGRATED TRAINING MODELS OF VOCATIONAL EDUCATION**

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- **Choose an appropriate model for Indian Vocational Education**
- **Policy has to be created for work-integrated training of students**
- **Plan certificate courses, in soft skills such as communication skills, computer literacy, digital literacy, basic financial literacy, entrepreneurship and many other topics, can benefit students greatly in the intern.**

# REFORM INDIAN VOCATIONAL EDUCATION

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- **Industry specific curriculum, skills and cognitive talents**
- **Collaboration with the employers**
- **Capacity development of vocational institutes**
- **Quality improvement of the instructional materials, industrial training**
- **Faculty development through industry**
- **Internship/ apprenticeship training**
- **Continuous process improvement**

THANK YOU

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YOUR  
QUESTIONS  
PLEASE