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World Confederation of Productivity Science (WCPS) was founded in 1969 as an apex professional body for promotion and development of Productivity Science across the Globe. WCPS brings together individuals and organisations who share common aims and objectives of Social, Economic and Environment (SEE) Productivity. WCPS regularly organizes World Productivity Congress (WPC) in member countries to deliberate on Topical Productivity Challenges. WCPS also organizes relatively smaller customized Regional Conferences and Seminars for the benefit of Regional participation.

WCPS has two Divisions, World Academy of Productivity Science (WAPS) and World Network of Productivity Organizations (WNPO).

World Academy of Productivity Science is the Academic Division of WCPS engaged in Research, Education, Capacity Building and Knowledge Management. WAPS honors Experts, Academicians, Researchers and Productivity Professionals by inducting them as Fellows of WAPS.

World Network of Productivity Organizations is the Network of Organizations across the Globe engaged in promotion and development of Productivity Science. WNPO organizes events and Training programs with support of member organizations.

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Message from the President - WAPS

Rallying Fellows to Develop Productivity

The response of Fellows of WAPS to the July 2022 inaugural issue of our International Journal of Productivity Science (IJPS) has been quite encouraging and the outlook bright - for example, the editorial team reports that articles are being submitted by Fellows and productivity professionals from various parts of the world!

With IJPS, we now have a prestigious means to showcase productivity development and to regularly communicate with Fellows and other productivity specialists. Our Fellows enthusiastically assured the Journal's successful and continual circulation by providing insightful papers and conducting peer reviews of submitted papers.

As exciting is the Knowledge-Sharing Forum (KSF) introduced in September 2022. Our first KSF event took place on September 17, with "Productivity Strategies for Achieving Sustainable Development Goals" as the theme. This set the stage for our second event, "Climate Change: Implications for You and Me," which was successfully held on December 8. Our third event, "Making Education Vocational for Greater Employability," was conducted with flying color this year on April 21. Our fourth event, titled "Importance of Health and Wellness for Global Productivity," is scheduled for August 10. Please connect with the WAPS secretariat / KSF organizing team for speaking and sponsorship opportunities. Your participation in WAPS's events makes the Academy stronger.

We, Fellows of WAPS, are recognized as individuals for our knowledge creation and sharing, performance results achieved, and/or policy implementation accomplishments, which distinguish us as contributors to the field of productivity science.

Starting 2023, the Academy will induct Fellows as an annual event to honor esteemed individuals on their contributions to productivity science. The Fellow Nomination Board has already completed the nomination review and will soon welcome our new Fellows to the Academy. Early next year, you will receive an email from the Secretariat on Fellow nomination for 2024. Please don't hesitate to nominate productivity contributors to become Fellows of WAPS, and don't limit your nomination to your locale only, any distinguished productivity contributor around the world deserves to be considered for this honor. You can send nomination to the respective Regional Coordinator or to me (in regions that we have yet to engage Regional Coordinators).

We are also expanding our reach to other productivity professionals and entities to attract them to join the Academy as members. This will help us extend our network far and wide. I will send you more information about this initiative shortly so that you can help spread the word and possibly recommend this opportunity to your contacts.

The WAPS executive team cannot do all this alone. To make our programs possible, we need the support and participations of Fellows, and for Fellows to reach out to other productivity professionals to expand our network. In addition, WAPS Regional Coordinators are also our frontline personnel who coordinate with Fellows and prospective Fellows. Please connect with your Regional Coordinator or the WAPS executive team if you are interested to get more involved in contributing, participating and/or initiating a program.

Our up-coming initiative is to work hand-in-hand with our sister division, World Network of Productivity Organizations (WNPO). Induction of new Fellows by WAPS from new Territories / Countries can also help open doors to attract new members for WNPO, making WCPS / WAPS and WNPO more vibrant.

Last but not least, I am taking this opportunity to thank the WCPS leadership for supporting WAPS programs.

As always, please stay in touch - the executive team and I look forward to hearing from you and meeting you in person soon.

Sincerely yours,

Chen Shengchang

President, WAPS

Affective Productivity

-The significance of emotions in productivity- Remi Dairo

Abstract

The term "affective" is associated with emotions, mood, and feelings, which raises the question of how emotions are linked to productivity. While some believe that productivity is achieved by implementing efficient systems and utilizing machines and AI, emotions play a significant role in determining productivity levels. Emotions can either aid or hinder the completion of tasks. This research paper aims to investigate the impact of emotions on productivity and offer strategies for managing them to enhance output. The concept of Affective Productivity highlights the importance of emotions in productivity. Through this paper, I aim to shed light on the connection between emotions and productivity and provide insights into optimizing productivity by managing emotions effectively.¹

The paper begins by examining the link between productivity and emotions. Positive emotions such as joy, enthusiasm, and inspiration can enhance motivation and concentration, while negative emotions such as stress, anxiety, and boredom can impair productivity. The science of emotions is then discussed, including the role of the limbic system and the influence of neurotransmitters like dopamine and serotonin on mood.² The paper outlines various strategies for managing emotions to improve productivity, including mindfulness meditation, cognitive-behavioral therapy, and exercise. Developing emotional intelligence and self-awareness are emphasized as essential factors in recognizing and regulating one's emotions.

Finally, the paper showcases real-life examples of how individuals and organizations have successfully implemented emotional management methods to enhance productivity. These examples include incorporating positive psychology techniques in the workplace, introducing wellness programs, and promoting a culture of emotional intelligence. This research is relevant to those who work with people at different levels, such as in professional or business settings or interacting with customers globally, as the principles remain the same worldwide. By providing insights into managing emotions effectively, this research paper aims to optimize productivity and enhance performance.³

Emotions and Productivity

Understanding the correlation between emotions and productivity is crucial for productivity experts. Positive emotions such as joy, inspiration, and enthusiasm can boost motivation and focus, whereas negative emotions such as stress, anxiety, and boredom can reduce productivity.⁴ Therefore, managing emotions effectively is essential to optimize productivity. Emotions are complex and involve various parts of the brain, including the limbic system, which processes emotions, stores memories, and plays a significant role in decision-making and behavior. Positive emotions trigger the release of dopamine and serotonin, promoting feelings of pleasure and well-being, while negative emotions can activate the stress response, which can hinder cognitive function and decision-making.⁵

In the field of productivity, understanding the relationship between emotions and productivity is crucial. Positive emotions have been linked to increased creativity and problem-solving ability, while negative emotions such as stress, anxiety, and boredom can significantly impact productivity and cognitive function.⁶ To optimize productivity, it is essential to manage emotions effectively. Strategies such as mindfulness meditation have been shown to improve emotional regulation, reduce stress, and enhance cognitive function. Therefore, individuals and organizations should prioritize emotional management to improve productivity and achieve better results in the workplace.⁷

What to do...

Managing emotions effectively is a crucial skill that can significantly impact an individual's well-being. Mindfulness-

based practices, such as meditation, have been shown to reduce stress and anxiety by increasing activity in the prefrontal cortex, which is involved in cognitive control and emotion regulation. Regular meditation practice has been shown to reduce activity in the amygdala, a region of the brain that plays a crucial role in the perception of fear and anxiety. Exercise has also been shown to have a positive effect on mood, reducing symptoms of depression and anxiety by releasing endorphins, which are neurotransmitters associated with feelings of pleasure and pain relief.

Emotional intelligence (EI) is also an essential factor in managing emotions effectively. EI is the ability to recognize and understand one's own emotions and those of others and to use this knowledge to guide thinking and behavior. Individuals with high EI are better able to regulate their emotions, communicate effectively, and form positive relationships. Developing emotional intelligence involves becoming more aware of one's emotions and learning to respond to them in a healthy and productive manner. This can be achieved through practices such as mindfulness meditation, therapy, and self-reflection.¹⁸

Daniel Goleman's book, "Emotional Intelligence," is a seminal work in the field of emotional intelligence and provides insights into how emotions impact our lives. It outlines the five components of emotional intelligence: self-awareness, self-regulation, motivation, empathy, and social skills, and offers practical tips for developing each of these components. These skills are not only crucial for personal growth but can also have significant implications for workplace productivity. A study by the Consortium for Research on Emotional Intelligence in Organizations found that emotional intelligence was a better predictor of job performance than IQ or technical skills.¹⁹

Employees with high emotional intelligence are better able to work in teams, communicate effectively, and manage stress, leading to increased productivity and job satisfaction. Additionally, understanding the science behind emotions is essential in developing strategies for managing them effectively. Mindfulness-based practices, exercise, cognitive-behavioral therapy, and emotional intelligence are all effective tools for regulating emotions and improving productivity. By taking a proactive approach to emotional management, individuals can increase their motivation, focus, and overall well-being.²⁰

Mindfulness meditation is another effective technique for managing emotions, which involves bringing one's attention to the present moment without judgment or distraction. This practice has been shown to reduce stress and anxiety, improve focus and attention, and increase overall well-being. Mindfulness meditation has also been found to increase job satisfaction and decrease emotional exhaustion in employees, according to a study published in the *Journal of Applied Psychology*. By regularly practicing mindfulness meditation, individuals can learn to regulate their emotions more effectively and improve their mental health and well-being.²¹

Cognitive-behavioral therapy (CBT) is also an effective technique for managing emotions. CBT involves changing negative thoughts and behaviors to improve emotional well-being, while mindfulness meditation involves bringing one's attention to the present moment.²² A review of multiple studies found that CBT was effective in reducing symptoms of anxiety and depression and improving job satisfaction and productivity, while mindfulness meditation has been shown to reduce stress and anxiety, improve focus and attention, and increase overall well-being.

Regular exercise is an effective strategy for managing emotions and enhancing productivity. Research has demonstrated that exercise can decrease stress and anxiety, boost mood, and improve energy levels. A study published in the *Journal of Occupational Health Psychology* found that individuals who exercised regularly had lower levels of burnout and higher levels of job satisfaction.²³ Regular physical activity can help individuals cope with emotional challenges by providing a healthy outlet for stress and promoting overall well-being. Additionally, incorporating exercise into one's routine can lead to increased productivity and a more positive outlook on work and life.

Self-awareness is a critical component of managing emotions effectively. It involves understanding one's emotional responses and triggers, allowing individuals to regulate their emotions better and minimize negative impacts on

productivity.²⁴ Mindfulness meditation, journaling, and self-reflection are effective techniques for developing self-awareness. By becoming more self-aware, individuals can identify their emotional states and choose how to respond to them, leading to better emotional regulation and increased productivity.

Managing emotions is crucial in improving productivity and well-being. Mindfulness meditation, cognitive-behavioral therapy, exercise, and emotional intelligence are all effective techniques for managing emotions. Developing self-awareness through mindfulness meditation, journaling, and regular self-reflection is also essential. By taking a proactive approach to emotional management, individuals can increase their motivation, focus, and overall well-being.

Examples of organizations that used Affective Productivity wisely...

Examples of individuals and organizations implementing emotional management strategies to improve productivity highlight the effectiveness of these techniques. The implementation of positive psychology techniques, wellness programs, and a culture that prioritizes emotional intelligence are a few examples of emotional management strategies in the workplace. These strategies have been shown to improve employee satisfaction, reduce burnout, and increase productivity. By prioritizing emotional well-being in the workplace, organizations can create a healthier and more productive work environment for employees.

Positive psychology techniques and wellness programs are examples of emotional management strategies that can be implemented in the workplace to boost productivity. Shawn Achor's "happiness advantage" concept emphasizes that happiness and positive emotions are a prerequisite for success, rather than just a result of it. By implementing practices such as gratitude journaling, daily acts of kindness, and focusing on strengths rather than weaknesses, organizations have reported increased productivity, improved employee engagement, and decreased absenteeism. Achor has worked with companies such as Google, UBS, and KPMG to implement these concepts.²⁵

Wellness programs, which can include both physical fitness and mental health initiatives, are another example of emotional management strategies in the workplace. Research has found that employees who participate in wellness programs report lower stress levels and a 26% reduction in healthcare costs. Physical fitness initiatives can include on-site exercise classes or gym memberships, while mental health initiatives can include stress management workshops or mindfulness meditation sessions. By prioritizing the well-being of employees and promoting emotional management, organizations can improve overall productivity and foster a positive work environment.²⁶

Fostering a workplace culture that values emotional intelligence is a highly effective method of increasing productivity. This includes teaching employee's emotional intelligence skills, like active listening and empathy, and promoting open communication and constructive feedback. In a study published in the *Journal of Organizational Behavior*, employees who worked in environments that promoted emotional intelligence had higher job satisfaction and lower emotional exhaustion rates.²⁷

LinkedIn is an example of a company that has successfully implemented emotional intelligence strategies. The company's CEO, Jeff Weiner, has emphasized the importance of emotional intelligence in the workplace, making it a company-wide initiative. LinkedIn offers emotional intelligence training to all employees and encourages a culture of empathy and compassion.²⁸ Consequently, LinkedIn has reported increased employee engagement and satisfaction.

Numerous organizations and individuals have successfully implemented emotional management strategies to enhance productivity and well-being in the workplace. These strategies can vary from encouraging breaks and time off to promoting work-life balance and flexible schedules. Other effective strategies can include implementing policies that prioritize mental health, providing employees with access to therapy or counseling, and fostering a culture of transparency and open communication.²⁹

Overall, real-life examples serve as a testament to the power and efficacy of emotional management strategies in achieving success in the workplace. From positive psychology techniques and wellness programs to promoting emotional intelligence, these strategies have been shown to enhance employee engagement, job satisfaction, and overall productivity. By investing in emotional management strategies, organizations can create a supportive and positive work environment that benefits both employees and the company.³⁰

Google is another organization that has successfully implemented emotional management strategies. The company is known for its focus on employee well-being, and one of the ways it promotes emotional management is through its "Search Inside Yourself" program. Developed by a former Google engineer, Chade-Meng Tan, this mindfulness-based emotional intelligence training program has been shown to improve emotional intelligence and reduce stress levels among participants, leading to increased productivity and job satisfaction.

These examples demonstrate the power of emotional management strategies in improving productivity and well-being. By recognizing the impact of emotions on productivity and taking proactive steps to manage them effectively, individuals and organizations can achieve success and create a positive work environment. Whether through positive psychology techniques, wellness programs, or promoting a culture of emotional intelligence, there are many ways to implement emotional management strategies and reap the benefits in the workplace.

In Conclusion...

In conclusion, emotions have a significant impact on productivity, and it is essential to manage them effectively to achieve optimal performance. Positive emotions can increase motivation and focus, while negative emotions can decrease productivity. The science behind emotions provides a deeper understanding of the link between emotions and productivity, including the role of the limbic system and neurotransmitters such as dopamine and serotonin on mood.³² Managing emotions to improve productivity can be achieved through mindfulness meditation, cognitive-behavioral therapy, exercise, and developing emotional intelligence and self-awareness. Real-life examples of successful emotional management strategies in the workplace further emphasize the importance of managing emotions to boost productivity.

Valuable resources are available to help individuals and organizations manage emotions effectively to improve productivity. Daniel Goleman's book "Emotional Intelligence" provides a comprehensive guide to developing emotional self-awareness and understanding emotional intelligence. The Greater Good Science Center at the University of California, Berkeley offers research-based insights and practical tips on cultivating emotional well-being and resilience.³³ By recognizing the impact of emotions and taking proactive steps to manage them effectively, individuals and organizations can improve performance and achieve their goals. Overall, managing emotions is a critical factor in achieving productivity and success.

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Leadership Lessons for A Divided World

Thomas C. Tuttle, Ph.D.

Introduction

What is the role of a productivity center? What makes a Productivity Center valuable? What does a Productivity Center do? These were the types of questions that were being asked in the State of Maryland in 1977 by the Chairman of the State of Maryland's Economic Development Advisory Council? A member of that Council was also the Dean of the University of Maryland's Business School. The deliberations of this group led them to establish the Maryland Center for Productivity and Quality of Working Life and to locate it in the Maryland Business School. The purpose of the Center was to help retain and grow jobs in Maryland through programs focused on Information Dissemination, Training, Technical Assistance and Research. One of its strategies was also to promote union and management collaboration as a means of helping firms become more competitive. In 1978, I was privileged to become the Director of this organization.

At the time, there was no school to train Productivity Center Directors. Learning the job required attending conferences, visiting companies, and learning from peers. This was aided by the establishment of the NPN (National Productivity Network) which included over a dozen organizations, mostly University based, who were created at about the same time because of the closing of the National Center for Productivity in Washington, D.C. Internationally, the World Confederation of Productivity Science, which had its origins in India became a very valuable resource, served as the lead "professional society" for productivity center directors across the world.

For me personally, I was also fortunate to be invited to join the Quality Council of the U.S. Conference Board. This organization provided access to 3 meetings per year with the Chief Quality Officers of a wide range of Fortune 500 organizations for in-depth sharing of lessons learned in the field. Another opportunity for me came in Maryland for the chance to participate in programs run by the Aspen Institute based in Colorado. The Institute also had a facility on the Eastern Shore of Maryland which gave the institute access to Washington, D.C. and to policy makers in the nation's capital. Through the Aspen Institute, I had the opportunity to meet Forest Behm from Corning Glass. Forry had been President of International Operations for Corning and he coached the Chairman of Corning as he led their Total Quality Management (TQM) initiative. Forry became a very helpful mentor to me and helped the Maryland Center strengthen our capability to assist organizations with the deployment of TQM in Maryland organizations.

All the above, plus 13 years of consulting experiences in working with Maryland organizations, served as preparation for a phone call that I received in 1991. A major Maryland manufacturing plant whose employment base had declined from over 3000 to about 1200 was at risk of closing. Maryland's governor had sent his Director of Economic Development to France to meet with the Chairman of Renault. Renault was in the process of purchasing the iconic American company, "Mack Trucks," which was the parent company of the manufacturing plant located in Hagerstown, Maryland. The Governor's fear was that because Mack had been losing money, that after the takeover, Renault would close the Hagerstown plant and Maryland would lose 1200 jobs. The phone call to me came from Randy Evans, Secretary of Economic Development. He described the situation and told me that the assistance of the University of Maryland Center for Productivity and Quality of Working Life (MCPQWL) was part of the economic package that Maryland offered to Renault to help save the Hagerstown plant. This phone call launched a 16-year relationship between the Maryland Center and the Hagerstown Plant that began in 1991. While the Maryland Center during my 26 years as Director, worked with well over 100 Maryland organizations on a range of projects, no project illustrated the purpose for which we were created better than the Mack Trucks project.

This story is described in my book published in June 2020 entitled **"Transforming a Unionized Plant: Leadership Lessons for a Divided World."** The book describes the Productivity Center's role in the joint union-management

transformation. The story began in 1991 and continues to this day. The book describes 16 years of the process up until 2007 when key leadership changes in the plant occurred, when the Maryland Center's efforts ended, but after the future of the plant had been secured - at least to the point that any business can be considered secure. I had not visited the plant since 2007 until November 21, 2020. Although the facility and the business had gone through several product changes and modernization phases since 2007, the transformation is still underway as the plant owner Volvo Trucks, is continuing to adapt to changing customer requirements.

The Mack Trucks Plant in Hagerstown, Maryland opened in 1961 to produce diesel engines, transmissions, and axles for the Mack Brand. The Mack name had become an American Icon because of the stellar performance of its trucks in World War 1 and World War 2. This is when the famous phrase "Build Like a Mack Truck" entered American cultural history.

In 1991, thirty years after producing its first truck engine in 1961, Mack Trucks as a company was in a situation not unlike the situation faced by the United States today. It was divided into two "warring" union and management camps - due the personal animosity a few years earlier between the Mack CEO and the top UAW leader who was responsible for Mack. The Hagerstown plant was over 150 miles from its corporate headquarters in Allentown, Pa. but management and union leaders in Hagerstown could not avoid taking sides in this war. The Hagerstown leaders on each side of this divide were forced to play out "scripts" written by the Allentown leaders in their respective camps. As a result, Mack Hagerstown was also strongly divided.

The plant was so close to being closed that the week that the transformation process began, the Plant Manager called the Union President to tell him that it seemed unlikely that the company would be able to meet the payroll in the next week. He was unsure what would happen.

Fortunately, this story had a happy ending. By the end of 2007, the plant had been acquired first by Renault Trucks (RVI) and then Renault's truck business was purchased by Volvo Trucks. The Hagerstown site has become the headquarters for Volvo's North American Powertrain Division. After an investment of over \$400 million, and the implementation of new production technology and a new research and development center, the plant was finally assured of its future.

The decision by Volvo to invest in this plant was driven by several hard business criteria. However, a major element in the decision had to do with the workforce. Not only was there one of the greatest concentrations of talented and experienced diesel engine designers, technicians, and assemblers that one could find in North America, but the members of this workforce had demonstrated the willingness and the ability to change. Evidence of this came from the results of the of the transformation efforts that enabled the people of Hagerstown to create their future.

In this article I will illustrate the way in which the Productivity Center as a "university-based third-party neutral" was able to initially guide and then assist the transformation effort. I will also distill from the 16-year transformation effort some key lessons learned that enabled the Mack Hagerstown plant to transform and survive. These lessons learned have value for leaders of today who must guide their organizations through the challenges necessary to compete in a global, rapidly changing environment.

The relevance of the lessons learned from this story were stated clearly by Roger Johnston, the VP and General Manager of the Mack Hagerstown Plant from 1999-2007. When I interviewed him in 2019, I asked him why should someone today care about a story that took place 12 years ago? Here is what he told me:

"When you think about society today, we have so much of this identity politics, and it pushes people into corners. If we as a company stayed there, we would have died. So, as a nation can we find a way to get away from the "poles" that

the magnetism draws us to and take advantage of the collective intelligence we have as a nation? We need to use that collective intelligence for our competitive benefit. If we don't others will. "

In essence, the challenge that the Maryland Center faced was to assist the union and management leadership of the plant to help enhance the collective intelligence of the work force and use that collective intelligence to create a future for a plant that was in danger of closing in 1991.

Lessons Learned from the Hagerstown Plant Transformation

Lesson 1 -Financial resources were necessary but not sufficient to move the plant to a more competitive position. The plant required a major culture change. This required external consulting assistance as well as external financial assistance from the State of Maryland.

In 1991, Mack had lost \$180 million for the second consecutive year, and it was obvious that significant restructuring would be required. It was uncertain what that would mean for Hagerstown, but there was a high probability that Renault could close the plant. This is what prompted Governor Schaefer and his Secretary of Economic Development, Randy Evans to travel to France to meet with the Chairman of Renault to intervene. The State of Maryland offered a financial incentive package to Renault, and the package also included funds for consulting assistance from the University of Maryland's Center for Productivity and Quality of Working Life which I directed. It was fortuitous that the Secretary of Economic Development realized that financial resources alone were not sufficient to enable the company to become and remain competitive.

In the first meeting involving the plant manager, the Union Shop Chairman, and me, the plant manager asked the Shop Chairman if the UAW would be a partner in a joint union-management effort to save the plant. The Shop Chairman's response spoke to the tribal culture that existed. He said "We will participate if the University of Maryland is involved. But if this is just more Mack 'bullshit' forget it." The Shop Chairman was well known as a man who spoke his mind. To the UAW, the University of Maryland involvement provided a "neutral third party" that they could trust. That connection also in the Union's eyes gave the University consultants sufficient "stature" so that their actions could not easily be co-opted by the company. The decision to involve the University of Maryland, gave the intervention more credibility than if the plant manager had hired ABC Consulting Company which might just have preached the company line. Given the situation, it was necessary for a neutral third-party consultant to assist the transformation process. It was necessary that both management and the union had to change and a "third party" was required to bring that message.

As the Director of the Maryland Center for Productivity and Quality of Working Life, I was the leader of an organization that had been established by the State Department of Economic Development and the University of Maryland College of Business and Management for the purpose of improving union-management relationships. This was viewed to help Maryland firms improve productivity, retain, and create jobs and strengthen the Maryland economy. By 1991, the Center had been in operation for 13 years and had worked with several productivity improvement efforts in both unionized companies and non-union companies. In addition, through our involvement in the U.S. Conference Board Quality Council we had the opportunity to gain knowledge from many of the leading companies in the nation on their total quality management practices. The Center also had an Advisory Board comprised of representatives from business, labor unions, State government, education organizations, and professional associations. We could draw on these organizations for advice and guidance. When the State of Maryland realized that the Hagerstown plant was at risk, it was fortunate to be able to engage the Productivity Center that prior State leaders had the wisdom to create. Our experience prepared us very well to be able to assist the Mack Hagerstown Plant.

Lesson 2- A structured change management process designed by the University of Maryland Center for Quality and Productivity (UMCQP) provided a pathway for the transformation. Due to the experience described above, we were able to bring to the Mack Hagerstown challenge a proven change process that could be adapted to Hagerstown with the

involvement of management and the UAW here.

The methodology proposed to the company involved three phases - 1. Planning, 2. Implementation and 3. Making Total Quality A Way of Life. The Planning process included an organizational assessment by the Maryland Center team followed by the establishment of a Joint Union-Management Guidance Team for the Change Process. The Guidance Team was co-chaired by the Plant Manager and the Union President. As the lead consultant from the UMCPQ I served as the facilitator for this team. Management members were the Plant Manager's direct reporting managers, and the Union members were the key Union Committeemen. The Guidance team met bi-weekly for approximately 2 hours and attendance was mandatory for all members. We followed a rigorous meeting agenda with meeting evaluations for each session. The work of this team consisted of developing the vision and mission statements for the plant, developing the quality, suggestion, and communication/suggestion policies for the plant. The Team also developed the key performance indicators for the plant, established the pilot quality improvement teams, outlined the quality improvement methodology that would be used and defined the Quality Leadership Action Areas (QLAA's) that would be addressed. QLAA's represented the 10 areas that were essential elements of the culture change. These included sustained commitment, communication, quality teams, visible performance measurement, development of people, recognition, etc. The results of the development work done by the Guidance Team was packaged into a 20-hour training program for all plant employees. In essence the planning process served to involve the Guidance Team members in a group development and learning process. This was a critical phase to help the union and management leaders of the plant develop an understanding of and a sense of ownership of the change process. The Phase 2 Implementation Phase consisted of the launch of the 20-hour plant-wide training described in Lesson 4 below and the launch of quality improvement teams to identify and remove root causes of quality problems to provide examples of concrete results to demonstrate that the quality improvement methodology worked.

Lesson 3 - Effective organizational change can only be driven by the CEO and, in unionized organizations, by the CEO and the Union leadership as partners. Consultants can assist but cannot lead. In Hagerstown, Ross Rhoads, Bill Nutter and Jim Stewart were the courageous individuals at the beginning who were willing to take the leap of faith to lead the change process outlined by the University of Maryland facilitators. At this point, the greatest asset we all had was the recognition that "survival was at stake". These leaders did not know with certainty that they would be successful. They were risking their careers. However, at that point, there were few other options.

The key mechanism that was conducted to define and drive the organizational change efforts was through the Guidance Team. This Team operated in parallel with the daily business of the plant which was to produce and deliver world class engines and transmissions to the truck assembly plants. One of my mentors was Forrest Behm, who served in his last job at Corning Glass as President of International Operations. "Forry," as he was called, used a metaphor to describe the necessity of this parallel organizational device - the Guidance Team. He said that coming to work today as a leader is like jumping into a whitewater rapids river. The minute-to-minute pressures of business are like the rapid current that sweeps you downstream until at the end of the day you jump out of the river and go home. In today's digital world, you may not even have the chance to jump out of that river as the rapid tides continue to move you downstream if you carry your digital device in your pocket or purse. The purpose of the Guidance Team in this metaphor is that it forces you to drag your foot along the riverbank to exert some control of the environment that surrounds your work and that is largely out of your control. The 2 -hour, bi-weekly guidance team meetings force leaders to focus on the "important" issues rather than just the "urgent" issues. Actions to change the culture, listen to employee suggestions, enhance employee skills, take time to analyze and improve performance measurement methods, recognize employees for excellent performance are examples of "important" issues that may not get sufficient attention while you are being swept down the whitewater river and dealing with the "urgent" issues.

Lesson 4 - Plantwide training for all employees, led by the organization's top leaders, is essential to develop an

understanding of the need to change and to develop the knowledge and skill to behave differently. The decision to invest in a 20-hour training program for all employees in the plant was another courageous decision. Too often, when companies are losing money, training is one of the first expenses to be cut. The plant manager, Ross Rhoads, made the decision, in a very difficult period, to take all employees in groups of 20-25 off the job for 20 -hours without asking permission from Allentown, to provide training for all plant members. This impressed the union leaders that the plant manager was committed to this process and was willing to take a career risk to involve the union employees in this process. The union insisted that the training be voluntary for UAW members. It was not optional for management employees. Over the next year over 90% of the UAW members volunteered to participate in this training that was delivered by teams of union and management employees who had been trained as trainers. The plant manager and the UAW local President kicked off each training session on Monday and came back on Friday to listen to the employee reactions. Their presence together as union and management leaders was an extremely powerful signal that they were serious about changing the culture and performance outcomes of the plant. A side benefit of this process was that the need to prepare for their training "kick-off" sessions and discuss the employee feedback required additional meetings between the plant manager and union president. This helped them develop a close trusting relationship that paid other dividends in terms of other initiatives required to move the plant forward. Ross Rhoads, the plant manager, speaking about the training said ***"out of 1100 people, I bet we did not get 10 complaints. It was the most productive thing we had ever done."***

There are several different models for rolling out plant wide training. In the Mack implementation we considered three. One was to have managers cascade the training down to their direct reports, who in turn train their next level employees and so on down the organization. A second model was to have the consulting team deliver the training. A third model is what we chose. This model required asking for volunteer trainers from the employee workforce along with volunteer supervisors to be trained as trainers to deliver the material. Training teams of three, typically 2 union employees and 1 supervisor comprised the teams. This process had several advantages. It spread out the training burden since the time required to train all the plant employees in groups of 20-25 took almost a full year. Second, the "trainers" became "champions" on the plant floor for the messages communicated by the training.

There is an important caution with respect to any training. Training creates expectations that the messages delivered in training will be consistent with what employees encounter on the job. This can cause training to backfire if these expectations are not met. In the Mack transformation, plant wide training was done at three different times over the 16-year period. We experienced some "backfires" especially in the cases when the training led employees to expect to experience greater workplace participation in decision making. Not every supervisor had the skill to make the transition from "giving" orders to "engaging employees in decision making." When we had these "backfires" it required a combination of "coaching" by the supervisor's manager and formal supervisory training to help build the supervisory skills required to create the new culture.

Lesson 5 - External Recognition Served as a Reward and Motivator

As plant performance improved, there was recognition in the local and regional press. In addition, a major recognition event came from Maryland's U.S. Senators Paul Sarbanes and Barbara Mikulski awarded the plant Maryland's highest award for Business Excellence- the U.S. Senate Productivity Award. This award recognized the significant performance improvements between 1991 and 1994 such as:

- Over 80% improvements in Engine Quality;
- Over 30% improvements in Engine Productivity;
- Almost 200% improvement in inventory turnover; and
- Over 90% improvement in lost workdays per 100 workers.

These were stunning performance improvements, and they came during a year in which the market for trucks was

booming and the combination led to dramatic profitability improvement for the plant and company.

For the first time since 1991, this recognition enabled the plant community to celebrate what they had accomplished and begin to believe that the plant truly had a future.

Following this significant recognition, there was a tendency for the organization that had been working hard to escape the constant fear that the plant could close, to take a "deep breath" and relax a bit. That did happen in Hagerstown.

Lesson 6 - When an organization raises the bar on performance expectations, to be effective, it must be accompanied by a supportive and enabling leadership style.

In 1995 and 1996, Mack's owner RVI, under pressure to maintain profitability and generate capital for continuing plant modernization raised the performance requirements for Hagerstown. The new goal was 200 engines per day. Ross Rhoads had been replaced as GM by a young French engineer Olivier Vidal who did not have a supportive and enabling leadership style. Olivier was a smart engineer who was skilled at managing and improving the technology, but his people management style tended to be "my way or the highway." The result was that the UAW Leaders chose to withdraw from all the employee involvement efforts that had helped produce the significant performance improvements up to 1994 and the 200 engine per day goal was never met. This was in response to several actions by the plant manager which they interpreted as a failure to show respect for the union employees. The cooperative union-management climate that had been established by the previous plant manager had been destroyed by the new General Manager.

This action by the UAW, to withdraw from the various employee involvement processes caused performance in the plant to drop dramatically. This got the attention of RVI and by the end of 1998, Olivier was reassigned to a job in Spain.

After Olivier was replaced in 1999 by Roger Johnston the management climate dramatically improved. Roger brought a cooperative leadership climate that respected the role of the union and the capabilities of the hourly workforce. This style and the rebuilt partnership with the UAW enabled the plant to reach the 200 engine per day target that had never been achieved.

Lesson 7 - Managers and Technical Professionals tend to underestimate the intelligence and capability of the workforce. As a result, there is a tendency not to share information that should be shared, a failure to push decision making down to the workforce and a failure to equip workers through training to contribute as much as they can contribute.

During the initial total quality training, Ross Rhoads was surprised at how effective the union members who were trained as trainers were in conducting the training. However, upon reflection he said he should not be surprised because when they were off the job these people were school board members, Sunday school teachers, coaches, ministers, and elected officials.

Roger Johnston, the new VP and General Manager who replaced Olivier Vidal, described this tendency with some self-reflection that occurred earlier in his career before he came to Hagerstown. Roger had gone to college at the General Motors Institute (GMI) and graduated with a degree in Manufacturing Engineering. One of the requirements of GMI was that engineering students had to spend a considerable number of hours working on the assembly line as an hourly worker. They rotated through several different assembly jobs which gave them a great perspective of factory work from the union employee perspective. Here is how Roger described the tendency of Senior Manager's and technical professionals to underestimate the capabilities of the hourly workforce.

"As manufacturing engineers, we sometimes think we know better than the people who do the work how to do this better. I completely forgot what I told myself back when I worked on the line (during his GM Institute College Training) about valuing the guy who does the work. The manufacturing engineer in me, liking to turn the wrench myself caused me not to seek the input of the guy on the line. ..Eventually, I threw away all that high and mighty stuff and I finally realized - Hey I need to talk to the guy who is doing it. "

Lesson 8 - Symbols Matter Over the 16-year Transformation, there were many examples of symbolic changes and actions that helped support and accelerate the culture change. The theme of many of these changes were to eliminate or reduce the symbolic status differences between management and hourly employees. The goal was to symbolize we are all on the "same team."

In the early period these changes included the elimination of relics of the old culture such as reserved parking spaces for managers, closing the executive dining room, and eliminating the different colored badges and shirts which signified whether the employee was a union member or a member of management.

Later in the transformation after Roger Johnston assumed the VP of Manufacturing role, some additional symbolic behaviors were carried out. On one very hot day when the external temperature was over 90 degrees and probably over 100 on the shop floor, Roger gave the order to bring coolers filled with Ice water to the assembly line areas. This had never been done before and it symbolized his respect for workers and sent the message that Roger cared for and understood the difficulty of performing in a hot plant. Also, once a week Roger went over to the union hall to meet with committeemen and update them on relevant issues and to seek their input. For the plant manager to regularly go to the union hall and meet with union leaders on their "turf" it sent a powerful message that Roger respected them as human beings and viewed them as partners in making the plant successful.

Roger Johnston had been VP of Manufacturing for only a little over a year when it was announced that Mack and Renault Trucks had been acquired by Volvo Trucks. Once the deal was announced, it remained uncertain whether Volvo would choose to maintain powertrain production in Hagerstown or build a new powertrain manufacturing plant. Since it had very strong leverage over the management and union in Hagerstown until that decision was made, Volvo used their leverage to extract greater flexibility from the UAW with respect to work rules in the union contract. The management and union were forced to open the contract and engage in collective bargaining twice before Volvo was satisfied that its requirement of "greater flexibility" was satisfied.

This was a painful process for the leaders of Hagerstown and Volvo's "hardball" tactics left some "singd feathers" among both the management and union leaders. However, once Volvo committed to invest over \$400 million dollars to modernize the plant to make their next generate diesel engines in Hagerstown, the plant leaders were again able to breathe a sigh of relief.

After Volvo assumed control and brought in Sten-Ake Aronsson from Sweden to be the Senior-Vice President in charge of the Volvo North American Powertrain Division now located in Hagerstown, there were rumors that Volvo would eliminate everything associated with the Mack Brand and the Bulldog symbol. One night, during a celebration of a performance achievement among a third shift group, Sten-Ake came into the plant to join the celebration and brought with him his new puppy - a very lovable bulldog. That coupled with a photo of Sten-Ake and his bulldog along with Mack President Paul Vikner that was published in the company newsletter helped put to rest the rumor that the bulldog would be history.

Symbolic acts such as these make a difference when they are consistent with other behavior.

Lesson 9- World-Class Performance Requires a True Partnership Between All Management and the Union

Employees Aligned Toward Common Shared Objectives.

A true partnership means that every person in the organization feels the responsibility to meet the customer's requirements today and to care for our co-workers, technology and systems that enable us to do that tomorrow and into the future.

A big step in this direction began on Roger Johnston's first day in the plant. On that day, Jim Stewart, the union president, took Roger on a walking tour through the plant and introduced him to many of the key opinion leaders in the UAW - both in Local 171 and in the Engineering Local as well. Jim promised his members that this "new guy" would be different from what they had experienced under Olivier Vidal. Jim risked his reputation but saw this as a way to "turn the page" from the recent painful past.

The formal "Partnership for the Future" initiative was launched by the joint union-management Guidance Team with several specific elements designed by the Union and Management leaders to secure the future for Hagerstown. When it was launched, there were rumors, but they did not yet know the plant was about to get a new owner. However, the goal of the partnership was to make the plant worthy of continued investment and thereby assure its future.

One of the first elements to create a true partnership was a significant effort to analyze the personal values of the manufacturing management team and the union leadership team. The values analysis was conducted by administering the Hall-Tonna Values Survey to the management and union members of the Guidance Team. The survey measures 125 human values and leads to a rank ordering of the 125 values for each survey participant. The purpose was to develop a consensus set of values that both management and the union agreed upon as the set of values that would serve as the foundation for the Partnership for the Future. This consensus set of values was chosen through a structured process facilitated by the UMCQP. The process began with individual feedback to each participant to clarify their individual values. Next there were a series of facilitated group meetings involving the management and union members that lead to a selection of approximately 25 values that were shared by all members and that were chosen as the consensus values for the plant.

This analysis pointed out that despite the management and union labels, the two groups had many values in common. It also pointed out that where there were differences, if the values of the two groups could be merged, the resulting set of values would provide a stronger foundation for the partnership than if it was based only on the values of either group alone. This rigorous process to build a common set of shared values led to the four principles chosen as the foundation for the Partnership for the Future. The 4 principles were: Individual Dignity; Continuous Improvement; Mutual Responsibility and Collaboration; and Performance Excellence. Each principle was defined based on a cluster of elemental values that was chosen to form the principle. Using a chemistry metaphor, the 125 individual values were like the periodic table of elements and represented elemental values. The "principles" were like "compounds" created by combinations of the individual chemical elements.

Other key elements of the Partnership initiative were Teams, Training, and Accountability Measurement to Assure that the Values were being lived in the workplace.

One of the key steps in moving toward a true partnership and living the espoused values resulted from a critical decision Roger made early in his tenure in Hagerstown. The plant still had the goal to produce 200 engines per day. To do that, the engine block line needed to produce 200 blocks per day. They had never produced that many. Roger made the unpopular decision to contract out enough block production to make up the gap between what was required and what the plant had demonstrated it could produce. He knew that only the people on the block line had the knowledge and ability to produce 200 blocks per day, but they had never done it. Roger stated it this way: ***"That group of people had the ability to get us there. But we were not, as an organization, yet to the point where they felt the responsibility to do that."***

...Our challenge was to move to the point that "we are all in the same boat. If we don't row fast or plug the hole in the bottom, we are all going down. So, let's see how we can do this together."

Union leaders in the plant, instead of fighting this decision, took it as a challenge to show Roger and the world what they could do. They stepped up to the challenge. They showed that the plant could produce more than 200 blocks per day and Roger cancelled the out-sourcing contract.

This accomplishment represented a very large step toward the goal of creating a true partnership in which all people felt the responsibility to meet customer requirements today and in the future.

Lesson 10 - World Class is a Moving Target. It is easy to throw out the term- World Class Performance. But what does this really mean? Who defines what World Class really means. Does Volvo, as a supplier define what world class means?

Quite simply, world-class in a global marketplace is defined by the customer. Since customer requirements change as the world changes, the definition of world class today will be different tomorrow. This is the reason why organizations are forced to continuously improve.

This Hagerstown plant is here today, because, unlike many manufacturing plants in this country, this plant has been able to strengthen the union-management partnership and continuously improve its performance. It was their willingness and ability to adapt and change that attracted the investment, especially by Volvo that assured the future of the plant. If the leaders and members of the UAW local union had not demonstrated the ability in 1991-1994 to change, RVI would not have chosen to keep this plant open. And, if this plant led by three different General Managers and three different Union Presidents between 1991-20007 and their committeemen had not demonstrated the ability to change old habits and union rules that once had been considered sacred, Volvo would not have invested in this plant.

My final question to Roger Johnston was "why should someone today care about a story that happened over 15 years ago?" In his answer Roger clearly saw the relevance of this story to the world the U.S. lives in today. He left us with this challenge:

"As a nation, can we find a way to surpass our differences and use our collective intelligence for our competitive benefit? If we don't others will."

Roger believed that the moral of the Hagerstown story is that they have shown the world how a group of people could overcome their differences to tap their collective intelligence to achieve success in a rapidly changing world.

Thank you, Hagerstown, for your example to the nation and the world.

Concluding Thoughts

In this story, it was important that the Maryland Center for Productivity and Quality of Work Life was a university-based organization that was perceived as neutral with respect to the management and union relationship. Neutrality was essential at the beginning of the transformation project and a couple of other times over the 16 years when the "train came off the tracks" because of tension between management and the UAW. As the book was being written, an interview with David Perkins highlighted this issue. David had been elected President of the Hagerstown UAW Local Union in 2004. He worked closely as a partner with the VP of Manufacturing Roger Johnston during the roll-out of the Volvo Production System from 2004-2007 where the book ended the story. However, David remained in Hagerstown as

UAW President after Roger Johnston left the plant in 2007. When I interviewed David in 2021, he had moved from Hagerstown to the UAW Regional Office in Baltimore as the Director of Skilled Trades for the Union. He still had responsibility for Hagerstown skilled trades since this was in his Region. He had the unique perspective to see how the transformation described in the book played out after 2007. Here is how David described the importance of a "3rd Party Neutral" university-based, productivity center as the facilitator of the transformation process.

"Bill Nutter was right. Had this been a program run by Mack, it would have failed. They could have run it, maybe just as good as you did, but it would have still failed because we (the UAW) would not have bought into it. From the union perspective, it was not just any third party. If you had been the third party as "Tuttle National Corporation", it would not have worked. But Dr. Tuttle, from the University of Maryland carries a tremendous amount of weight. From the union member's viewpoint, they say I can buy into that. It is not just some company they (Mack) hired who will just preach the party line. They look at you as a truly independent source of information and thought process.... I will tell you that every UAW member when we talked about this, everybody was fine with it because it was from the University of Maryland and that made it legitimate. This is not something they (management) are trying to push on us. They are not going to get the University of Maryland to bend their way, because the University of Maryland is powerful enough to maintain its independence. So, they trusted you."

The key word in David's comment is trust. The key lesson is that when the conflict between union and management has led to a lack of trust between the parties, the intervention must be led by a third-party neutral who can be trusted by both parties. In this case, being from the University of Maryland was critical in bringing that trust. It also helped, that we brought a tested facilitation methodology for managing change. But without trust, no methodology would have been successful.

Model For Making Skills Aspirational

Dr Sunil Abrol

Abstract:

The current, Education, Skilling and Hiring Model is not working. University/Colleges are producing a large number of unemployable degree holders across disciplines. Skill Certification is not in demand as skilling is seen to be relevant for blue collar jobs. Employers do not get trained and skilled candidates against their requirements, leading to gap in demand and supply. Employers end up making huge investments of time, effort, money, in selection and induction training to get work ready employees. There is need to change education and skilling policy to make skilling aspirational for students. There is need for integration of Education, skills, jobs and Entrepreneurship. All stake holders need to play crucial role in making the Education- Skills- Apprenticeship Mode successful. The model envisages skills to be part and way of life. Students would get exposed to Business Sense, Soft Skills, Psychomotor skills, Moral education as part of school education to inculcate love for skills in children. This would also help students to choose higher education courses matching their aptitude and interest. Universities / Colleges would need to develop courses with knowledge and skills getting equal exposure. Apprenticeship with employers for hands on experience to real life expectations at work place would be critical to success of the model.

Implementation of Education-Skills-Apprenticeship model would lead to a happy and economically stronger Society with youth becoming employable, professionally competent to take up professional careers and Entrepreneurship and industry jobs saving hugely on cost of hiring and training. The model implementation would have a huge impact on Economy.

Key Words : Education Policy and Implementation, Skills, Apprenticeship, Entrepreneurship, Employment .

Introduction:

Education vs Skills debate is never ending. Most Countries across the Globe have their education policies focused on education and qualifications as against skill development. Those nations eg. Germany, South Korea, that have included skill development as part of school education and life have done better in skilling their workforce.

Societies across nations respect education more than skills. Whether it is jobs, compensation, status, respect, value, or recognition, education qualifications get priority over skill certifications. Qualifications become the criteria for eligibility for jobs rather than skills or ability to do the job. Skills are meant for so called blue collar or lower level jobs and workers. Degrees/ Educational Qualifications lead you to white collar or superior positions in organisations.

This anomaly has led to poor quality education, race for mass production of qualified youth with many university degrees who are unemployed and unemployable. There is a huge gap in demand and supply. Those having degrees and educational qualifications do not have the requisite skills to perform the task for which they are to be hired. Consequently, employers end up spending huge time, effort and money in training these qualified youth with university degrees to make them productive to perform on the job. This is a great dent on company profits and national resources, opportunity loss and economy.

While lot of initiatives have been taken globally by UN organisations (ILO, UNDP, WB) National Governments to bring focus to skills, there is a confusion as to what is more important, Educational Qualifications or Skills Certifications. Even though Governments have created Ministries for Skills, Education and Entrepreneurship to give

give boost to each one of them , it is not giving the desired results. Employers continue to give preference to Educational Qualifications in employment. Entrepreneurship is considered to be for those who fail to get jobs as getting employed preferably in Government is first choice of youth.

The scenario needs to change if the National and World Productivity and Economy has to take a quantum jump. There is need for integration of Education (School and Higher Education) , Skills Development, Entrepreneurship and Employment. All of them are interrelated and need to be seen as a bunch together and not either or by all stakeholders namely Students, Parents, Teachers, Education Institutions, Governments, Employers, and Society at large. To make skills aspirational , there is need to correct the perception in the minds of all stakeholders that skills are meant for blue collar jobs and educational qualifications for white collar jobs. This perception will change only when skills become way of life in Society. Young generation needs to appreciate that skills are necessary for every walk of life , be it jobs, professional career, Entrepreneurship, Social work etc. Skills make them self reliant, confident, versatile , independent and ready to take on all kinds of life challenges with focus on areas of their interest and aptitude. Many years back , I met a trainer from South Africa. He shared with me a training module that was being used to Teach / Train Primary school students. The title of the course was "Business Sense ". I was surprised , as I could not imagine Business skills to be taught to Primary students as in India, Business Skills was not even part of Graduate programs in early nineties. The course focused in Basic Maths, Communication , English and Negotiation skills , skills that would be useful to a person in every walk of life.

Integration of Education, Skills, Employment and Entrepreneurship :

Let us explore the possibilities for integration of School education, Higher education, Skills, Entrepreneurship, professional Career, Social work and Jobs. An Education-Skills-Apprenticeship Model is a possibility. The policies, processes and systems of various stakeholders would need to change drastically.

Role of School : Schools need to develop course content for rounded development of the student from day one. Course content and pedagogy needs to change to make learning fun and engaging for the student. Schools to focus on Learning concepts as well as skills. The focus should be on Life skills (soft and Hard) that will help the child to be independent. As the child grows in higher classes in school , he / she be offered options to pick up courses/ skills of his/ her interest/ aptitude. School education to include regular courses , classes for Business Sense (Maths, Communication, Negotiation), Behavioral Skills (soft skills and Emotional Intelligence), Value / Moral Education, Psychomotor Skills (Gardening, Cooking , Carpentry, etc.). This would help in imparting Life Skills and developing respect for Dignity of Labor/ Skills.

Role of Parents : Parents need to learn to let the children choose their career path and choose courses/ skills they love and enjoy. **Role of Higher Education Institutes :** Universities/ Colleges would need to make major shift the way they operate today. University/ Colleges would need to offer only courses that have linkage or relevance to a profession/ job role/ career. Generic qualifications will need to be dropped. Diploma/ Degree/ PG programs would have to have component of Knowledge/ Skills and Behavior relevant to the profession. Class room and laboratory based teaching and Training would not be enough to give students requisite exposure to real life issues and make them competent to perform on the job from day one of employment. Current practice of Summer Training, Industrial Training practiced by educational institutes is not working. Students end up getting certificate with very little real experience. Articleship for Chartered Accountants and Internship for Doctors is a model that is working well and prepare students for the real world. Universities / Colleges would need to introduce Diploma/ Degree Apprenticeship Model. Where students get both Knowledge on relevant concepts as well experience on the job to get real life situation and conditions. This model can have multiple combinations of class room and on the job learning. What is important is that student spends almost

same time on the job learning with an employer as conceptual learning in the class room. For implementation of the Education-Skills-Apprenticeship Model , universities/ colleges would need to focus on content (relevant to job) which would need to be developed in consultation with line managers and supervisors of job. There would be need to focus on outcome or competencies development. Consequently the examination/ Assessment and Certification process would need to be both Formative and Summative with focus on assessment of competencies acquired and demonstrated. There would be need for development of course content not only for class room teaching, but also for On the Job training/ Apprenticeship. Involvement of faculty during Apprenticeship is critical to ensure correlation between class room learning and on the job learning. there would be need to develop processes for delivery and assessment in line with content. One of the critical component of this model is the role of Employer Managers/ Supervisors during Apprenticeship/ On the job Training. They would need to be trained about their role, expectations and responsibilities. There would have to be Training of Faculty and Mentors(Industry Managers) for effective implementation of the model. At the end of the Education-Skills- Apprenticeship Model completion, the student would be fully equipped with knowledge, skills and behavior. The student would be job ready. There would be no need for employer to train him/ her through Induction Training. The student would also be ready to be an entrepreneur if he/ she so desires. Global experience demonstrates that Internship/ Apprenticeship has resulted in employment of students in the same organization where he/ she had undergone Internship/ Apprenticeship. This would address the issue of gap between employer needs vs availability of right candidates. Would also save employers huge hiring and training cost besides advantage of having productive work force from day one. Role of Employers : Employers (Govts, Corporates ,Industry, MSME , Service Providers) will need to change their mind set and so called Rules and Regulations/ Policies to move away from Educational qualifications based hiring to competency based hiring. The Job Specifications/ Job descriptions/ Eligibility Criteria for various jobs/ positions will have to be modified to make it competency and skill based . This alone will make a visible change in perception of students and parents towards skills. This would also need to change for promotions and career growth to motivate employees to upskill and upgrade themselves for movement to higher level positions as against current practice of seniority (no. of years of service/ experience) with no relevance to skills and competencies for the new role. Role of Government : Government has a major role to play. Implementation of Education- Skills-Apprenticeship Model would need Govt to make major changes towards integration of Ministries of Education, Skills , Entrepreneurship , DPIP and Employment and Labour. There is need to make consistent policies and eliminate overlaps. Govt. would need to ensure quick transformation of Universities and Colleges from traditional to Education-Skills Apprenticeship Model.

Govt. would need to introduce policies to enforce active participation of Employers. Skills Cess Model of Uk is an interesting model where employers pay upfront Levy to Govt. which is refunded to employers against expenditure on skilling including Apprenticeship. One will have to think of a model which not a burden on employers but an incentive. Current scheme of Stipend and reimbursement of Training cost under NAPS is not enough motivator for employers, resulting in poor outcome.

While the Education-Skills- Apprenticeship Model may look good on paper, the success of the model will depend a lot on role of all stake holders and quality assurance of the entire ecosystem. A mass communication/ education campaign would be needed to bring all stake holders on board for the success of Education-Skills- Apprenticeship Model. This is the only hope if Unemployment challenges have to be addressed. This will save citizens huge wasteful expenditure on acquiring educational qualifications leading to unemployed youth , make students employable, students would earn while learning, save industry cost of hiring and training and give them opportunity benefit of using employees from day one, contribute to national productivity and economy leading to benefit to Global Economy.

Meteorology Can Be a Key to Enhance Environmental Wellness

Anita Y. Tang

Abstract

The effects of Earth's warming are impacting all living beings because we all live in one big and connected global-climate system. While countries from all over the world are pledging to reverse climate change, they do not stand on the same level playing field.

At COP27, Global South managed to convince Global North to drop its opposition to a "loss and damage" fund to help developing countries that face some of the worst climate impacts. There is no doubt that financing is a key to helping level the playing field. But, funding is finite.

In this paper, I raised two points for consideration: One, all countries should work hard to combat climate change, to reach their 2050/2060 pledge. However, they should not lose sight of the need to deal with the increasingly frequent and severe climate threats we are currently experiencing. Two, certain nations have existing skills, experience, facilities, and systems that can accurately forecast weather and provide early warning so that the appropriate adaptive actions can be taken. The haves should help the currently have nots on the preventative front so that we can all build on existing experience for the entire world to become more climate resilient.

Meteorology - Study of the Atmosphere

Ancient Greeks invented the term "meteorology," the study of atmospheric disturbances. Aristotle is considered the founder of meteorology. Around 340 BC, Aristotle tried to explain the weather through the interaction of the four elements: earth, fire, air, and water. His student Theophrastus produced the first book on weather signs, listing observations used to forecast weather, many of which are still used to this day.¹

In today's term, meteorology is a science that deals with the atmosphere and its phenomena. Such phenomena impact every bit of human lives and affect the ecology and survival of other living beings.

Weather is the conditions of the atmosphere over a short period of time, and climate is how the atmosphere behaves over relatively long periods of time.²

Climate Change

Meteorology is concerned with long-term trends in climate. Climate change is on the minds of many people and certainly on the agenda of most countries.

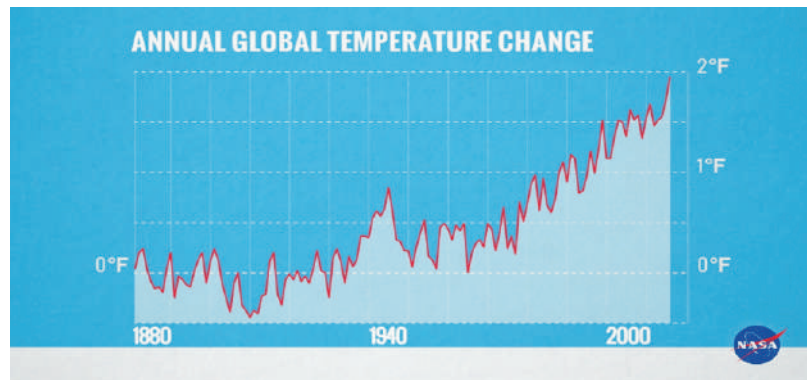
Climate change describes a change in the average conditions in a region over a long period of time. Global climate change refers to the average long-term changes over the entire Earth. These include warming temperatures and changes in precipitation, as well as the effects of Earth's warming, such as rising sea levels, shrinking mountain glaciers, ice melting at a faster rate than usual in Greenland, Antarctica, and the Arctic, and changes in blooming times of flowers and plants.³

Earth's climate has constantly been changing - even long before humans came into the picture. However, scientists have observed unusual changes recently. For example, Earth's average temperature has been increasing much more quickly over the past 150 years than they would expect.

Some parts of Earth are warming faster than others. But, on average, global air temperatures near Earth's surface have

gone up about 2°F (~1.1°C) in the past 100 years.

Figure 1: Change in Annual Global Temperatures, 1880-2016



Source: NASA's Goddard Space Flight Center, <https://climatekids.nasa.gov/climate-change-meaning>

Many people, including scientists, are concerned about this warming. Oceans, land, air, plants, animals, and energy from the Sun all have an affect on one another - Earth's climate functions like one big, connected system. As Earth's climate continues to warm, the intensity and amount of rainfall during storms such as hurricanes is expected to increase. Droughts and heat waves are also expected to become more intense as the climate warms.

When the whole Earth's temperature changes by one or two degrees, that change can have big impacts on the health of Earth's plants and animals, and, obviously, human beings.

Climate Pledges from Countries Around the World

Approximately 2.5 trillion tons of carbon dioxide equivalents (CO₂e) have been released into the atmosphere since humans started emitting carbon dioxide (CO₂). We continue to release 50 billion tons of CO₂e each year, a major cause of global warming.⁴

Climate change represents a pressing and potentially irreversible threat to human societies and the planet. In December 2015, 193 parties (192 countries plus the EU) adopted the Paris Climate Agreement. The long-term temperature goal of this international treaty is to strengthen the global response to the threat of climate change by "holding the increase in the global average temperature to well below 2°C above pre-industrial levels and pursuing efforts to limit the temperature increase to 1.5°C above pre-industrial levels, recognizing that this would significantly reduce the risks and impacts of climate change."

According to a United Nations report issued on October 26, 2022, countries around the world are failing to live up to their commitments to fight climate change, pointing Earth toward a future marked by more intense flooding, wildfires, drought, heat waves, and species extinction.⁵

Without drastic reductions in greenhouse gas emissions, the report said, the planet is on track to warm up by an average of 2.1-2.9°C, compared with pre-industrial levels, by 2100. That is far higher than the goal of 1.5°C set by the landmark Paris Agreement in 2015, and it crosses the threshold beyond which scientists say the likelihood of catastrophic climate impacts significantly increases.

Expand Use of Meteorological Data to Enhance Environmental Wellness

While climate change is a worldwide issue that demands immediate and concerted actions, we need to pay attention to

and deal with weather conditions that the world is currently facing.

Record-breaking storms, forest fires, droughts, heat waves, and floods are resulting phenomena of climate change, which prompted countries to pledge efforts and embark on a long and challenging journey to reverse. We, however, should not lose sight of the present, on how we should adapt the appropriate steps and put forward solutions to handle effects of climate change - something happening right now, in increasingly frequent intervals, and negatively impacting people's life around the world.

Modern weather prediction works when meteorologists gather large amounts of data from accurate sensing devices on Earth and in space about past and current weather and use complex computer programs to estimate future weather.⁶

I, like the majority of the population, use weather forecast to determine if I should bring an umbrella or wear a pair of sunglasses when going outdoor, put on layers of clothes or what not. In a larger sense, accurate weather forecast has much bigger implications. Accurate weather forecast beyond a week, for example, as pointed out by a Brookings report, "matters a lot to a farmer who has to decide on optimal timing for planting, harvesting, and irrigation; or an electric utility manager who needs to plan for the expected supply of solar or wind energy to the grid. It matters to airport, train, and truck operators who worry about major weather events impeding their functions; to those engaged in preparation for and prevention of weather-related disasters; and to insurers who need accurate historical and projected weather and climate data to assess price risks."⁷

Accurate weather forecast is needed to develop appropriate measures to control and mitigate weather-related disasters, protect people's lives and properties, and keep economic loss to the possible minimal. In fact, meteorology, if applied appropriately in different facets of society, not only can reduce climate change's negative impact in our society but can possibly increase positive impact.

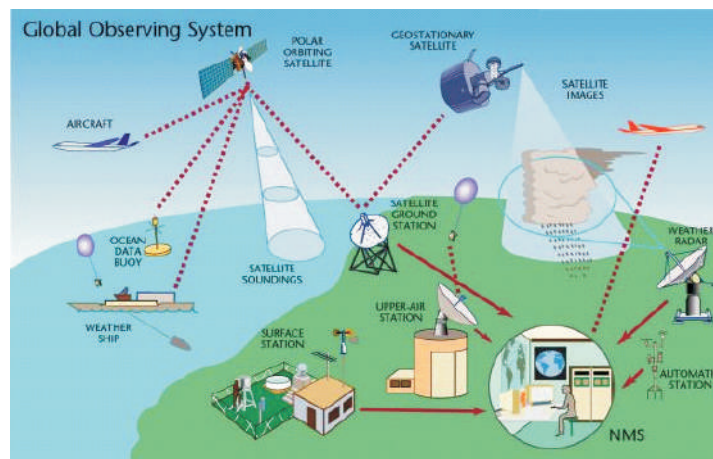
Improving Weather Forecast is Key

As asserted by the Brookings report, improve weather forecasts to reach the highest possible prediction accuracy for future trends in global, regional, and local climate change depends on the quality of the "value chain." This can lead to better weather forecasts, early warnings, and climate services. The chain starts with weather data collected in many locations around the globe. These data are shared and uploaded into global weather prediction models that are used for all global, regional, and local weather and climate predictions. These predictions are disseminated to commercial and government users as well as potentially affected populations, all of whom benefit in terms of improved economic production, disaster preparedness, and risk mitigation.

Weather stations collect data on land and sea. Weather balloons, satellites, and radar collect data in the atmosphere.

The huge amounts of data collected constantly by a vast array of weather devices all over the world make weather forecast models as accurate as they are now. Today, thousands of instruments all over the world, as well as in space, are constantly recording and transmitting data to scores of weather networks. National Weather Service (NWS) of the United States noted that weather satellites are an important observational tool for all scales of its forecasting operations - satellite data provides a global view, and is complemented by land-based systems such as radiosondes, weather radars, and surface-observing systems.⁹

Figure 2: Global Observing System



Source: Climate Currents, <https://climatecurrents.org/ways-and-scope-of-measuring-weather>

The United States Dominates the Field of Meteorology

There are different meteorology institutions around the world, and most of them are government agencies. Of the 54 government agencies listed on Wikipedia, nine are U.S. agencies.¹⁰

In addition to these nine government agencies, the National Aeronautics and Space Administration (NASA), an independent agency of the U.S. Federal Government, is a strong contributor to the national weather-forecasting goals, primarily through the development and use of data from space-based sensors. Rose Croshier, Policy Fellow at Center for Global Development (CGD), affirmed that space-based services make up a growing slice of the data mosaic necessary to build a strong forecast. They tend to specialize in large weather patterns and can cover gaps left by a deficit of radar and other surface and air-based sensors.¹²

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Further, of the best universities for meteorology and atmospheric science in the world - listed by EduRank - based on their research performance in these disciplines, 13 of the Top 15 are located in the U.S., and only one each in the U.K. and Japan.¹³

Satellites Orbiting Earth¹⁴

As of September 1, 2021, Earth has 4,550 satellites in orbit. They are grouped in four categories:

- Low Earth Orbit (LEO)
- Medium Earth Orbit (MEO)
- High Elliptical Orbit (HEO)
- Geosynchronous Orbit (GSO) / Geostationary Orbit (GEO)

The second biggest of these four categories is GSO/GEO - 565 - with orbital speeds that match Earth's rotation.

They are used for telecommunications and Earth observation.

These 4,550 satellites serve eight main purposes: Communications (63.0%), Earth observation (22.1%), Technology development (7.8%), Navigation / Global positioning (3.6%), Technology demonstration (0.77%), Earth science (0.44%), Space observation (0.22%), and Space science (2.3%).

The top five countries with the most satellites orbiting Earth are: U.S. (2,804), China (467), U.K. (349), Russia (168),

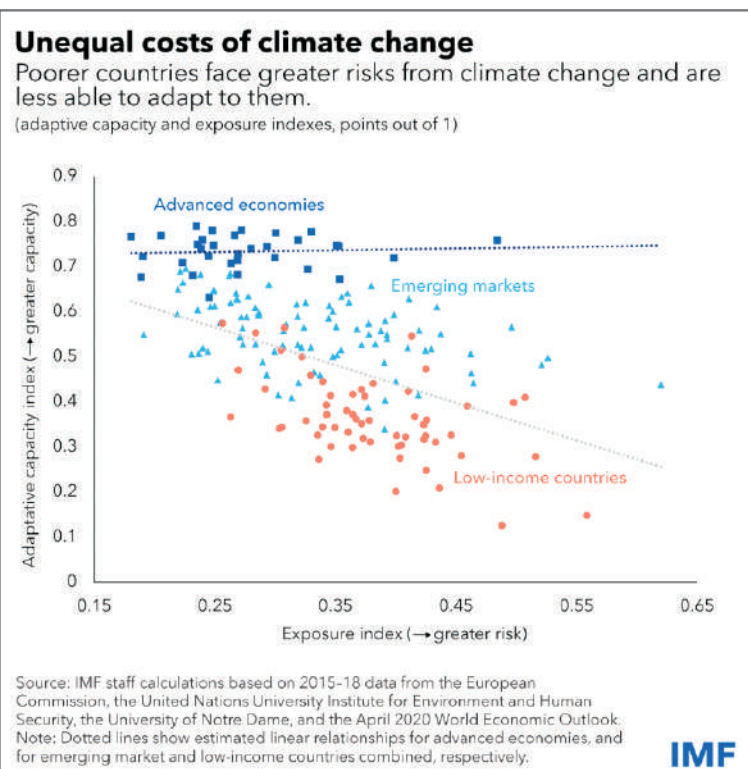
and Japan (93). They collectively own 3,881 of the satellites orbiting Earth, amounting to over 85 percent of the total.

Figure 4: Satellites Owned by Countries



Source: <https://dewesoft.com/dq/every-satellite-orbiting-earth-and-who-owns-them>

Figure 5: Unequal Costs of Climate Change



Source: <https://www.weforum.org/agenda/2022/11/carbon-neutral-climate-resilient-developing-countries-cop27>

Resources Should be Allocated Equitably To Assure Optimal Climate Outcome

The mildest contributors to planet-heating emissions suffer the same consequence as heavy contributors because we all live in one big and connected global-climate system. In fact, poorer nations are bearing the brunt of the harm caused by rising temperatures as a result of emitted pollution by industrialized nations heating the Earth.

A key focus of COP27 held in Egypt in November 2022 is about finding ways for the developed world to help the developing world to become climate resilient. At the Conference, low-income countries asked for "loss and damage" to be added to climate financing while some rich countries favored using the new Global Shield Against Climate Risks Initiative - a social-protection and insurance-based finance mechanism for the loss and damage outside the United Nations Framework Convention on Climate Change (UNFCCC) process.

Whether it is "loss and damage" or insurance-based finance, they are "after the fact" actions. Why not take preventative measures to reduce the loss and damage?

Green Climate Fund (GCF) executive director Yannick Glemarec stated in a November 17, 2022, interview that the Fund was already using about 30 percent of the roughly US\$11 billion in resources it has deployed so far for activities that fall under efforts to avoid and minimize "loss and damage." They include projects to strengthen early warning systems and build infrastructure such as roads and embankments that can better withstand climate shocks and stresses, as well as provide weather insurance for farmers.

Rich nations pledged, in 2009, US\$100 billion a year by 2020 to help developing countries manage the impacts of climate change and become climate resilient. They have not reached this target in any year since and the need is only growing. The United Nations now estimates that US\$300 billion a year is needed to support climate action in developing countries. Should some of this money be used in preventative actions to avoid and minimize loss and damage?

Hydromet

In a December 1, 2017, World Bank brief, it noted that hydromet (hydrological and meteorological) hazards are responsible for 90 percent of total disaster losses worldwide. Hydromet services provide real-time weather, water, early warning, and climate information products to end users, based on weather, water, and climate data.

The Alliance for Hydromet Development was created in December 2019 at COP25 to close the capacity gap on high-quality weather forecasts, early warning systems, and climate information.

The First Hydromet Gap Report by the Alliance for Hydromet Development, released on July 8, 2021, estimated that 23,000 lives per year could be saved and potential annual benefits of at least US\$162 billion could be realized by improving weather forecasts, early warning systems, and climate information. It highlighted how investments in multi-hazard early warning systems create benefits worth at least 10 times their costs and are vital to build resilience to extreme weather. And, yet, only 40 percent of countries currently have effective warning systems in place, and large gaps remain in the vital underpinning observations-data upon which these services depend, particularly in Least Developed Countries and Small Island Developing States.

Takeaway

Doing all we could to reverse climate change is important as it can help ensure a livable Earth for the many future

generations to come. However, we also need to take care of all of us who are now living on Earth and constantly living under the threat of more frequent and more severe climate disasters.

Professor Petteri Taalas, Secretary General of World Meteorological Organization, noted in a forward to the First Hydromet Gap Report, "Science-based, data-driven weather and climate services are the foundation for effective adaptation measures."

Prevention is better than cure. No one is out of the climate-disaster woods until everyone is out. Financial help is certainly a route, but not the only route to go. Countries with applicable expertise should work with countries that lack it - and help them become climate resilient. Think hydrology, think meteorology, think satellites orbiting Earth.

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National Economy and Industrial Development: Green Energy Innovative Integration Technology in Grid

Prof Rajendra Kumar Pandey

The national economy and industrial development are linked with the energy sector such as coal, power, oil and gas. The availability of quality coal and oil are limited for industrial and other applications. The GHG emission is known and its adverse effects on the health and environment at large is also well studied and reported at various forums. The natural calamity is associated with environmental imbalances which may be observed now a days quiet often as cloud burst and ocean turbulence and earthquake. The production cost of industries is very closely governed by the power price as a key factor. The emergence of new technology of solar and wind power generation and evacuation at remote load centres has open the gateway for massive industrial low-cost production if appropriately made available in real time depending on the requirements of industries. This may require the integration of innovative technology solutions of Green Energy evacuation through the Green Corridor and providing open access to renewable energy in real time power market for ensuring the cheapest power in entire country. The observations regarding real time power flow by POSOCO/POWERGRID through the transmission network by integrating Green Energy in the Grid and ensuring its availability at remote end industrial houses/industries/commercial organizations has been very promising and commercially viable. The only challenge as on date has been the massive Green Energy integration and its evacuation at remote end load specially under intermittency. It's noticed on various occasions that during intermittency the power injection pattern is modified which may affect the Grid operations hence a very detailed system planning has to be done with energy storage options in the transmission and distribution network utilising the benefits of large, pumped storage and battery storage depending upon the respective zone. The Green Energy Corridor with special feature of advance control to regulate the power flow at the desired location is the need of hours. The utilities associated with power generation and transmission & distribution now have to work in unison in order to have a quality power supply at the cheapest price for industrial houses and commercial organization as well. This concept paper outlines not only the challenges of Green Energy integration such as Solar, Wind and Bio Energy but also the new emerging Hydrogen Energy production and storage for industrial applications and fuel cell driven vehicles to provide the Green Transportation starting from the two-wheeler to four-wheeler and heavy load vehicle such as Truck and buses as well. The goods train and passenger trains may be also driven by hydrogen and fuel cell providing the entire green hydrogen massive usage in transportation sector thus minimising the stress on the existing lines feeding the electrified Train corridor. This concept will provide the stability to Grid and least excursion to existing assets of transmission and distribution networks.

Overview on the Energy Scenario:

Coal accounts for 37% of the global power supply. Particularly in Asia, it remains a preferred fuel of choice due to its abundance and well-developed thermal-related infrastructure as compared to the developing renewable energy infrastructure. Rapidly declining cost of renewable energy, emphasis on lower carbon footprint and rapidly increasing electricity demand, puts cleaner electricity at the centre of strategies for many developing economies including India for economic development. Sailing on the Government of India's ambitious nation-wide renewable energy capacity target of 175 GW by March 2022, which was recently updated to 450 GW by 2030 renewable penetration will reach significant levels in the overall Indian power mix. The variability of renewable energy presents a notable challenge to grid stability and reliability.

India's ability to manage grid in such scenarios is still untested and the necessary resources like flexible generation capacity, energy storage, demand management etc. seem inadequate. As per a recent report by POSOCO in May 20201, India's conventional generation capacity has limited flexibility with the report suggesting that only 36 units out of the 438 (~8%) thermal units analysed have achieved a minimum generation of 50% or lower, with only one unit (in Gujarat)

operated at generation level of 40% or lower. Thus, unless adequate aforesaid RE integration resources are developed & implemented, RE curtailment is inevitable with increased RE penetration. As per recent estimate, based on above mentioned planned RE capacity target and CEA estimated India's future demand projections, RE curtailment can increase to 10-15% by FY 2022 and >40% by FY 2030. RE curtailment is already a significant issue in many states in India including some of the ones highlighted above. Multi-pronged strategy is needed to address the above RE integration (or RE curtailment) issue and ensure that country's power supply-demand balance is maintained along the most optimal path. Some of the key steps for the same could be: (1) Acknowledging the urgent need for flexibility, (2) Supply and grid flexibility assessment, (3) Enabling market reforms

Hence, the ability of the Indian thermal power plants to achieve lower levels of technical minimums and to quickly ramp-up and ramp-down, i.e., operate flexibly vis-à-vis baseload operations gains unprecedented importance as a norm rather than an exception. Hitherto, flexible generation has not been a significant priority in India under grid conditions characterized by generation deficits and outages. One of the key reasons contributing to the lack of preparedness for flexible operations in India is the absence of sound regulatory framework and compensatory mechanisms for incentivizing required changes to the plant equipment, procedures and practices. It may be noted that the generation flexing is the only option as on date for accommodating the Renewable Energy and providing green energy to industrial houses but with upcoming evolving technology such as flexing transmission and distribution capacity with the deployment of Flexible AC Transmission System Controllers at appropriate location may drastically change the entire energy scenario. The Renewable Energy rich states may be connected with High capacity HVDC and HVAC lines with FACTS controllers which will facilitate the power flow from any location to other required location depending on the loading pattern of respective areas. The ATC of lines may be changed with FACTS controller to accommodate the RE power over and above the classical power from thermal power plants. One of the concepts for providing the cheapest power may be based on the methodology adopted such as:

1. The onset of the Renewable Energy power injection is tracked in real time along with the loading requirement of the transmission line at given point of time. The Thermal power available may be assessed in real time from various thermal power plants and in place of ramping down to the tune of RE penetration the power from thermal power plants is rerouted through the transmission corridor by FACTS controllers to the storage locations/industrial houses/farmers load and thus ramping down is avoided. This may benefit the thermal power plants management in terms of revenue and also cheapest power thus may be given to other loads of industrial importance/commercial organisations providing the product/services during that period at lower rates thus improving the economy of the country and this ensures sustainable development.
2. Solar power integration is expected to continue in the next few years, as governments push for renewable energy production to fight climate change. Further, solar power has the potential to be the most cost-effective renewable energy generation technology. Hence, the shortcomings of solar energy must be overcome with new and efficient technologies like energy storage systems (batteries) and mini/micro grids. Developed countries are now looking at energy storage systems to tackle solar integration problems. The use of energy storage systems for solar power is expected to grow in the coming decades due to its potential to stabilize the grid assets and reduce the dependence on thermal power plant back-ups. Instead of feeding the power generation directly into the grid, solar power can be fed into the battery, which, in turn, will supply power to the grid. This will enable the solar power plant to continue supply even when there is no active generation at night.
3. The utilities having pumped storage/energy storage may be planned at appropriate locations and the cheapest power may be stored for Grid balancing during intermittency. Also, with upcoming Electric Vehicles penetration in Grid, the cheapest power may be given to the respective states during the period in which RE energy predominant through open access. This may boost the Battery Swapping industries and also the cheapest power for charging the battery of Electric vehicles. Thus, it will not only allow more investment in the energy sector but also automobile sector and

distributed energy management as well.

Renewable Energy as Green Energy: Innovative Integration Technologies

The solar and wind energy have been found to manage the power demand in hybrid mode very effectively with intelligent control through Renewable Energy Management Centre. The Energy storage, specially pumped hydro storage and large NaS battery storage upcoming may play very important role for energy security once intermittency is observed by bridging the gap of power demand through intelligent power control. However, such technology requires a hierarchical control layer which can balance the power demand either under changing load scenario or intermittency very precisely thus ensuring quality power to the load.

With the increasing demand for electricity as the world shifts away from fossil fuels, cleaner sources of energy like solar and wind are becoming more and more common. However, as more solar power is introduced into national Grid, operators are dealing with a new problem that can be visualized as the "duck curve". In a world heavily reliant on electricity, utility companies have found better at using data to anticipate demand and trying to operate as efficiently as possible. Usually, power companies supply the least amount of power overnight while most consumers are sleeping, ramping up during the morning as people wake up and businesses get going. Then, at sunset, energy demand peaks. Utility companies use models to predict demand and operate as efficiently as possible by supplying more power during times of higher demand. But the introduction of solar power has brought about problems in these demand curve models. Since solar power relies on the Sun, peak solar production occurs around midday, when electricity demand is often on the lower end. As a result, energy production is higher than it needs to be, and net demand-total demand minus wind and solar production-falls. Then, when evening approaches, net demand increases, while solar power generation falls. This discrepancy results in a net demand curve that takes the shape of a duck, and the duck curve gets more pronounced each year, as more solar capacity is added and net demand dips lower and lower at midday. The drop in net demand at midday basically creates problems.

Solar energy production wanes as the sun sets, just as demand for energy typically peaks. Utility companies are having to ramp up production to compensate for this gap, often overstressing a grid that is not yet set up for these peaks. Traditional sources of energy like nuclear and coal are only economic when they are running all the time. If you have to turn them off at mid-day because the power is supplied by solar, they become economically unfeasible. Due to overproduction, solar power is already being wasted in some places where the technology is widely used, like California. The problem is most intense during summer or spring when part of the solar panels has to be turned off to avoid overloading or even damaging the power grid.

Flattening the Duck

With more countries starting to rely on solar power, there are many potential solutions for the duck curve being explored (and implemented):

Energy Storage: Overproduction of solar power during the day can be utilized by improving batteries and grid storage capacity.

Powering Alternatives: Extra solar power can go towards powering energy generation at night, such as pumping water for hydroelectricity or overheating a material to dissipate energy later.

Other Clean Sources: Unlike solar energy, sources like nuclear, hydroelectric, and geothermal can operate continuously and fill in the demand gap.

While grid managers study how to serve the new supply and demand, the duck curve is one of the greatest challenges

facing renewable energy.

Use of Mini Grids

Mini grids are essentially smaller power generating and consumption units connected to each other without being connected to the main electric grid. The structure of a mini grid improves the stability of the main grid as it reduces grid load. This structure isolates the mini grid from any instability in the main grid. Mini grids offer enormous potential to the developing countries to improve electrification and simultaneously increase grid stability. The use of mini grids in consumption-heavy regions with large solar power plants will reduce the heavy demand from the plants and the supply fluctuations from the off-grid solar power plant, thereby keeping the grid stable.

How Does this Affect Renewable Energy Procurement?

The last decade of growth in investments and integration in renewable energy was mainly driven by the various incentives that the governments worldwide provided for renewable energy production. One major part of renewable energy procurements from corporates comes in the form of self-generating power plants. These power plants are connected to the main grid to sell the excess power to the grid and to get feed-in tariffs (FiTs). Owing to the problems of solar power integration and the increase in electricity prices driven by the solar incentives, many countries have reduced their FiT incentives, with the net result of disincentivizing solar projects. With the reduced FiTs, the return on investment (ROI) of a solar plant increase with an increase in the levelized cost of energy (LCOE) of the plant. Hence, corporations with significant solar power assets should consider investing in battery systems to keep their LCOE lower despite the lower FiTs. Installing battery systems will reduce the LCOE of the solar power plant as they increase the output and the efficiency of the solar power plant. A solar power generation system with an energy storage system can power the facility even at night and essentially can act as a mini grid and decrease supply fluctuations.

Hydrogen Energy BHU Pilot Project Overview:

Hydrogen, the world's most abundant and lightest element, has a wide range of applications in industries such as Steel, Fertilizer, Refinery, Petrochemicals, Automobile etc. It is also one of the richest and efficient sources of energy. Hydrogen demand has been increasing in India and is expected to reach 11.7 million Tonne by 2030 from present 6.4 Million Tonne. Hydrogen, based on how it is produced, can be divided into 'grey' (produced from fossil fuels), 'blue' (produced from fossil fuels with carbon capture and storage) or 'green' (produced by using renewable energy to power electrolysis that splits water molecules into their constituent elements: hydrogen and oxygen). Traditional means of producing hydrogen generate large volumes of CO₂. With world's focus on decarbonization, green hydrogen (which is more environmentally sustainable) is receiving unprecedented interest and investments. The advances in electrolysis technology and the falling cost of renewable energy are enabling the mass production of green hydrogen and driving the cost of production down. These developments have changed the dynamics of hydrogen in India and have created a significant opportunity for our country to boost economic growth, achieve energy security, and move away from fossil fuels, creating an environmentally cleaner and sustainable future of the country. It is expected that demand for green hydrogen could reach 1.25 million tonnes by 2030.

OBJECTIVE:

The objective of the Pilot project is to synergize the engineering/R&D strengths of BHU, BHEL, & BARC and jointly work towards mitigation of the challenges being faced in the adoption of hydrogen economy in India. The project involves demonstration and study of:

- Production of green hydrogen [66 kg/day; 500kW Alkaline electrolyzer]
- Hydrogen refilling station [H₂ compressor, High & Medium pressure storage, Dispenser]

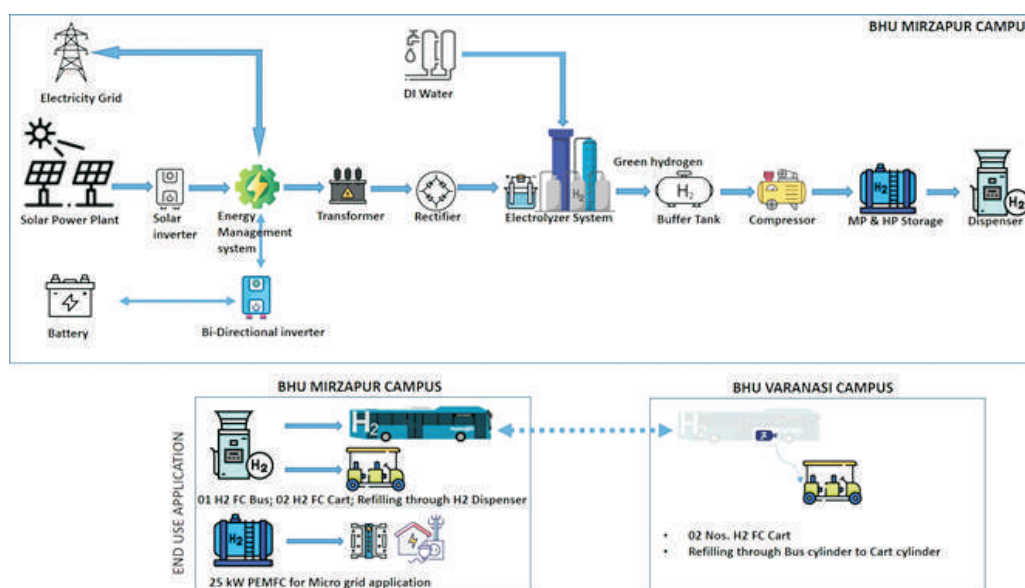
- Mobility application [9m FC Bus(01 No. 100 kW PEMFC) and Cart(04 Nos., 5kW PEMFC each)]
- Micro grid application for distributed power [25kW PEMFC] The overall pilot project layout is shown in Fig.1.

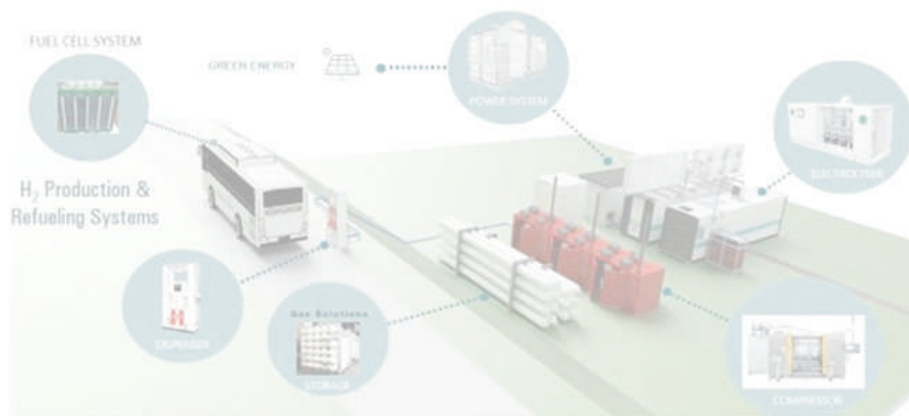
INTRODUCTION

The above-mentioned end-use application would require approximately 66 kg H₂/day. To cater this demand of green H₂, BHEL proposes to set up a 500kW Electrolyzer system for on-site hydrogen production at South Campus, Mirzapur. The electrolyzer system will be powered by 1MW existing Solar power plant (SPV) during the day, producing Green hydrogen. The green hydrogen produced will be stored and supplied for end use applications such as H₂ bus, Power backup and H₂ cart using BHEL in-house developed Fuel Cell (FC). The excess hydrogen (if any) can be used by BHU in its research laboratories.

DESCRIPTION

The alkaline electrolyzer system (500kW) will be powered primarily by solar power plant (1MW). However, as solar power is variable in nature, battery (300 kWh) has been considered in the system for adequate functioning of the electrolyzer. When the SPV output is more than the demand of electrolyzer, the battery will get charged and when the SPV output is less, the battery will provide balance power. In case of non-availability of electrolyzer system, the SPV output will be fed to grid. Further, in case SPV is not operational, the provision has been made where in the electrolyzer can be powered by grid electricity, in which case the H₂ produced will not be called green. The aforementioned management of electrical energy from the sources- SPV, Battery, Grid- will be achieved by Energy Management System (EMS), aptly designed for the desired purpose. The hydrogen produced will be compressed and stored in High pressure [250 bar(g)] and medium pressure [150 bar(g)] storage for cascade filling. The hydrogen will be dispensed through the dispenser. This whole infrastructure will be located at Mirzapur campus. For end use, the 9M hydrogen fuel cell bus (100kW FC) will ply between BHU Mirzapur and Varanasi campus. 02 FC carts will ply within Mirzapur campus. Further, 25 kW PEM FC based microgrid has also been envisaged to power a building in Mirzapur campus for 18 hrs. At Varanasi campus, 02 FC carts will be run for intra campus commute. These H₂ cylinders of FC carts at Varanasi campus will be refilled through special provision from Bus cylinders. The H₂ storage capacity on bus has accordingly been considered.





EXPECTED BENEFITS

1. The installed green hydrogen generation system would help to understand the Techno- Economical aspects of Green Hydrogen Generation, compression, storage, dispensation,
2. Experience of system engineering, integration, project execution including production, compression, storage, and dispensing of green H2 project with end usage.
3. Experience of safety aspects and Handling of hydrogen gas.
4. Further research on cost reduction and IPR
5. The success of this project will build confidence and lead as an example of Industry and academia collaborative effort. Such collaborations are much needed in the country to address the challenges of niche and emerging technologies.
6. Project will provide a platform for training and research on green hydrogen technologies to the academia and industry.
7. The pilot project will include indigenously developed systems (>80%) and will provide big boost to 'Atma nirbhar Bharat' vision of our honourable PM.

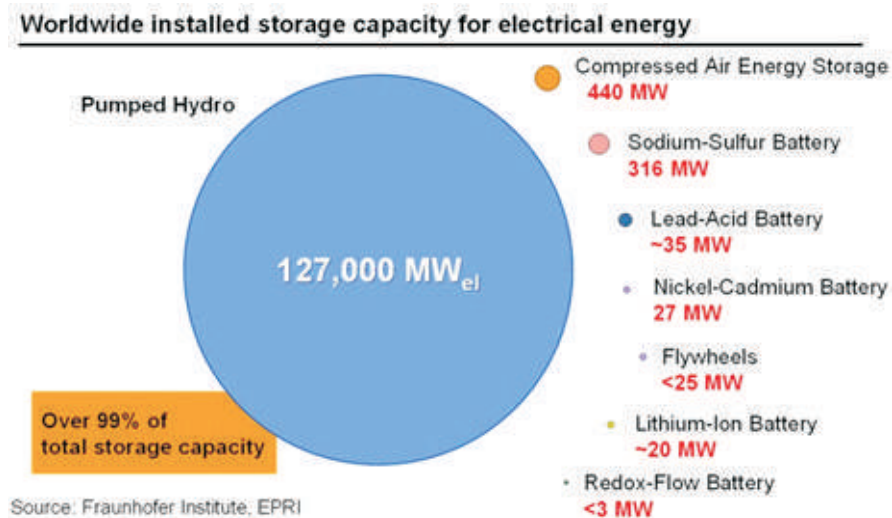
Storage Technology:

There are different options for the storage of electricity to make it available when needed in the context of the renewable (wind/solar) integration. The main technologies available or under development are: Large size batteries, Fly wheels, Pumped Hydro Plants, Compressed air, Hydrogen storage, Superconducting magnetic energy, Thermal storage

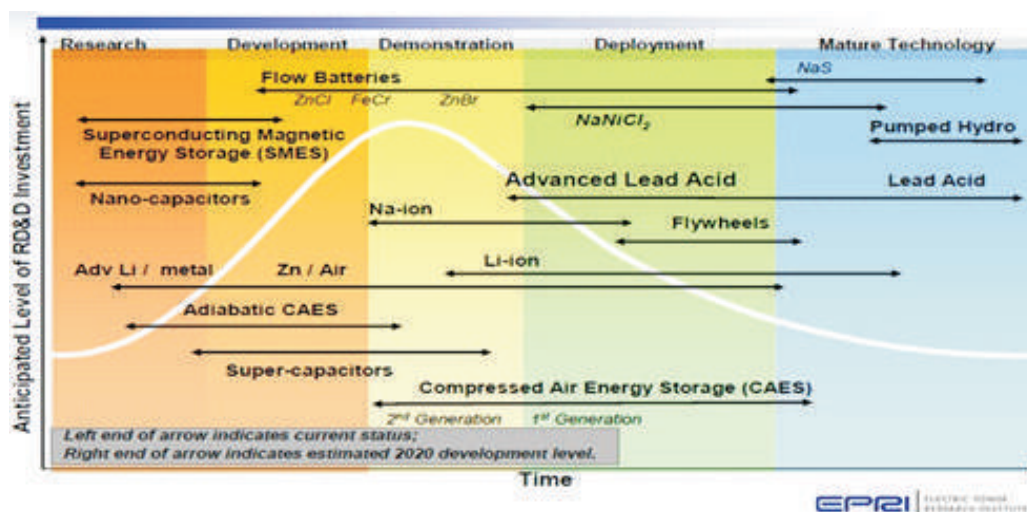
More than 99% of global grid scale storage is done today by pump hydro method. This method stores energy in the form

of water pumped to an elevation when the demand for electricity is low and utilized to generate power to meet the demand when required. But sites available for such pumped hydro systems are scarce in the Indian context. Batteries are portable, can be customized and are easier to install; thus, making them increasingly attractive for grid level storage. However, they still have high capital costs. With continued innovation and bigger production scales, large-scale battery storage should get more economic.

The picture below gives a relative ranking of some of the storage options--



Given below is an overall picture of storage technologies at various stages of maturity--



It's clear that NaS and Li-ion battery systems are amongst the front runners in the electrochemical storage sector, Sodium sulphur battery:

National status: No manufacturer and installation in India as of now.

International status: Sodium sulphur battery technology has been demonstrated at over 190 sites in Japan totalling more than 270 MW with stored energy suitable for 6 hours daily peak shaving. The largest sodium sulphur installation is a 34 MW, 245 MWh pack for wind stabilization in Northern Japan. Several projects are under development in Europe, as well as in Japan and the US. As of 2010, NaS batteries have been used by utilities worldwide in 221 projects with a total capacity of 316 MW. EPRI estimates that with current efforts the installed capacity of NaS batteries will increase to 606 MW. Currently, the only NaS battery manufacturer for utility scale grid applications is Japan based NGK Insulators Ltd. in collaboration with the Tokyo Electric Power Co. (TEPCo). A lower temperature version of the NaS battery is also being developed in Utah by Ceramtec. In March 2011, Sumitomo Electric Industries and Kyoto University announced that they had developed a low temperature molten sodium ion battery that can output power at temperatures under 100°C. This needs further validation. Recently, Posco, South Korea has also claimed the development of NaS battery, having more than 3 times higher density than existing batteries and a lifespan of more than 15 years. The largest system currently under construction is 34 MW/238 MWh NaS storage for the Rokkasho wind farm in northern Japan. On the R&D side, the electrolytes play a fundamental role in terms of current density, electrochemical stability and the safety of batteries and hence their continuous improvement and innovation are critical to the overall battery performance.

Li-ion battery:

Despite being one of the best battery systems in terms of energy density, the prohibitive cost has limited the large-scale deployment of LIB. A recent report from consulting firm McKinsey & Company predicts that the cost of lithium-ion batteries could drop to about \$200 by 2022. South America has more than 60% of global Li reserve and hence the Li based batteries would cost lesser in future when more manufacturing plants come up there. Many research groups around the world are working on high-capacity silicon-based anodes and manganese oxide-based cathodes for lithium-ion batteries, but so far these are not stable enough for grid applications.

Basic research needs to be carried out for developing the methodology for designing high power lithium-ion batteries for Indian requirements. This will require both mathematical modelling as well as experimental work. Mathematical modelling expertise, at different length scales (multi-scale), needs to be developed. The models, however, have to be translated to computationally fast models, so that optimization of design parameters (material, geometry and electronic circuit) can be done. Experimental validation would involve actual fabrication of the battery and evaluation of the performance.

National status: There is currently no manufacturing of lithium-ion battery taking place in India. Right now, all the lithium-ion batteries for various applications are imported, thus increasing the cost of the equipment/product enormously. India is putting significant efforts in the alternative energy sources - solar, wind etc. This sector will benefit significantly by the indigenous development of lithium-ion battery. The state of art batteries is mostly based on graphite anode and LiCoO₂ cathode/related systems. Use of LiCoO₂ makes the batteries toxic and there exists a problem of disposing them. Also, LiCoO₂ makes the batteries costly for Indian market. For Indian conditions much cheaper and environmentally friendly batteries are needed. Also, safer technology is a key issue in the Indian scenario because the safety awareness is not up to the mark. Alternate technological routes which produce safer batteries via safer procedures are mandatory. Thus research and development activities focused at designing lithium ion batteries, which are well-suited for Indian conditions, is indispensable.

Smart Grid: Future Grid Integration Concept

National and international: Smart Grids are an evolving transformation of the power system that use information and communications technology (ICT) to enable greater reliability, robustness, consumer choice (including grid-tied renewables and storage) and flexibility. It impacts all aspects of the power sector, from generation to transmission to distribution; a likely major thrust will be in distribution, which includes consumption. Many components of smart grids are available today; the main challenges include improving the price-performance and the integration of the solutions

in a manner that is open, modular, standardized, and scalable. Pilot Project "Design and Development of a Smart Energy Grid Architecture with Energy Storage" has been executed at BESCOM by IIT (BHU), Varanasi under the leadership of Prof Rajendra Kumar Pandey. The screen shot is shown below Fig 1 and Fig 2:

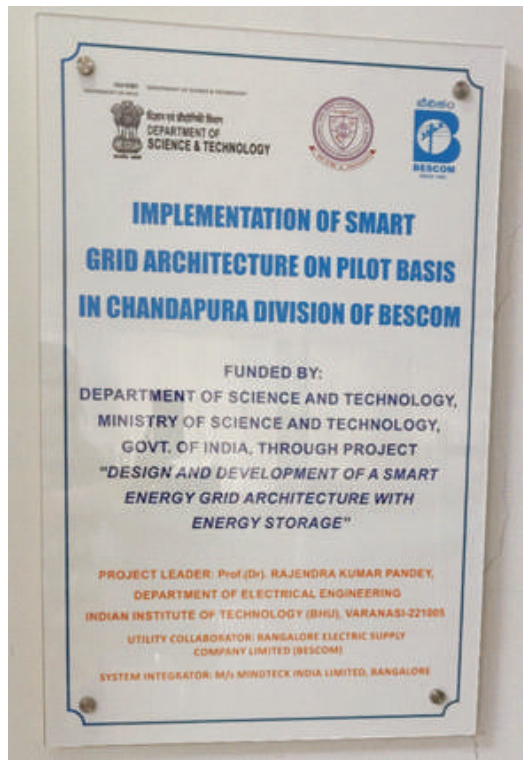


Fig 1 Smart Meter Operation Control (SMOC) Room BESCOM

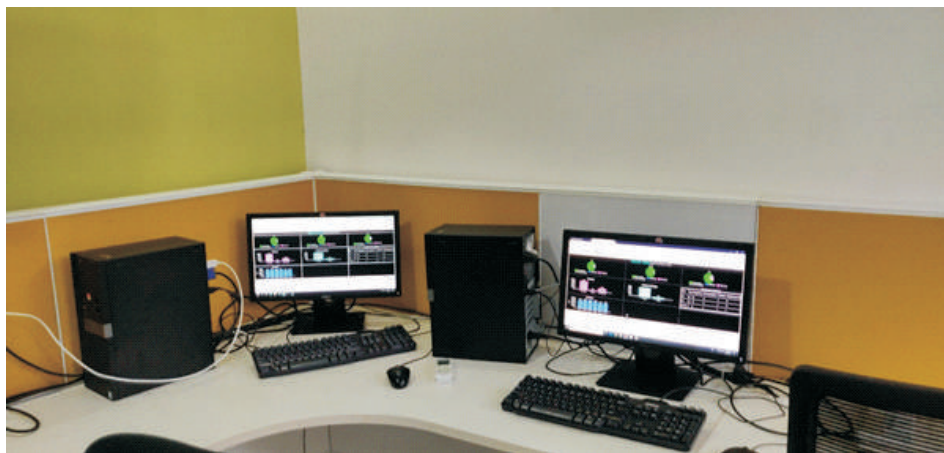


Fig 2 Server Communication in SMOC BESCOM

A Roof Top Solar Power Project with capacity of 6.025 MWp is executed at BHU having three different locations such as BHU main Campus, RGSC Campus Mirzapur and Kamachha Campus in main city of Varanasi utilising IoT and SCADA for real time monitoring and ensuring operation & control through data analytics. The screen shot of the Project is shown below Fig 3:

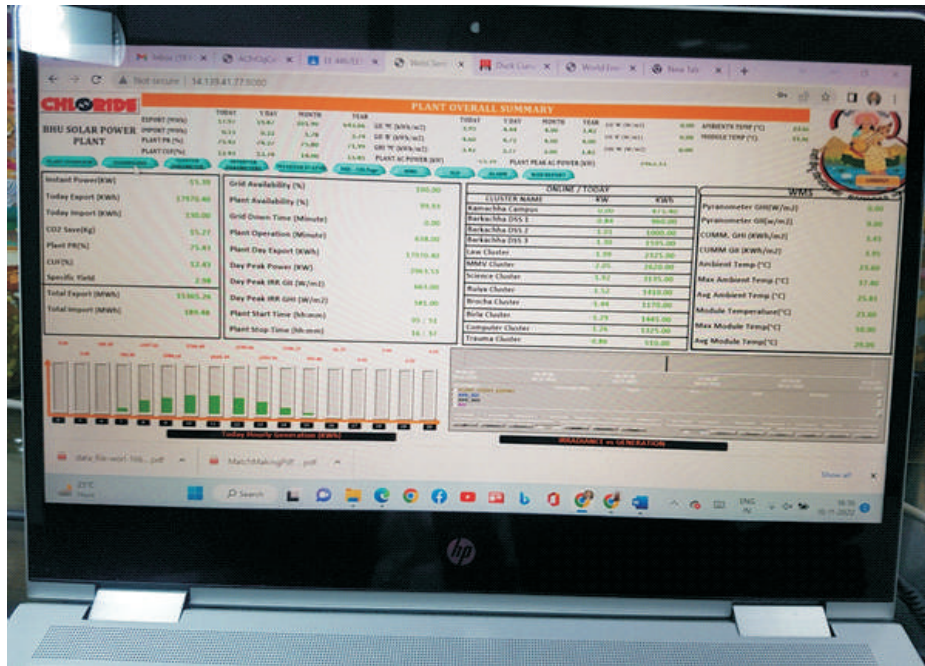


Fig 3 BHU Solar Power Project SCADA screen shot of Nov 10, 2022

Various utilities around the world have taken steps towards deploying a smart grid. A few nations also have regulations and legislation towards smart metering if not smart grids. Perhaps the largest deployment to date has been Enel, in Italy, where all 32+ million consumers have smart, bi-directionally communicating and controllable meters. However, with continuous improvements in technology, new deployments (e.g., Boulder, Colorado, or Southern California) are "smarter" in their capabilities. There are other projects ongoing around the world. As there is no "single" accepted level or standard for Smart Grids globally, the different utilities are in different states of implementation. Some utilities are at experimental level while a few are implementing smart grids commercially with main focus on smart metering. In developing countries like India, smart grids have not been the focus of the utilities given the other challenges they face, including supply shortfall, power theft, financial losses, etc. However, it is possible that they could leapfrog to smart grids, while at the same time using them as a means to improve their operating and financial sustainability.

The vision of this project proposal is to study the present grid conditions and future scenario with addition of renewable resources of different capacities. The analysis of the operational problems associated with substantial renewable resource penetration and examine the possible solutions like use of the Smart Grid Technology and storage options for smooth and safe operation of the network. It is also proposed to make an assessment of the requirement and economics of storage options to overcome the variability of the renewable sources of generation.

Critical to the planning and design of decarbonized grid architectures is a detailed understanding of the potential benefits, risks, costs, policy instruments, performance and reliability of the various technology options. An integrated assessment is required to avoid suboptimal solutions.

The scope of this project includes multidisciplinary fundamental and applied research, economic and policy analyses, development of framework for pilot projects and outreach. The activities are designed to gain the key fundamental understanding required for implementing smart grids with large-scale renewables penetration, and prepare a framework to test these ideas in the real world conditions.

Research Challenge

The present energy infrastructure is engineered for large-scale centralized conventional generation, transmission, and distribution. The present share of renewable sources such as solar and wind power is less than 12% in India. A future energy infrastructure capable of large-scale renewable integration presents the following challenges:

1. **Managing intermittency:** Solar and wind are inherently intermittent sources. Large variations cause serious operational difficulties, as experiences in several countries have shown. Earlier the variations in wind power generation in the state of Karnataka for four typical days have been observed. With an installed wind base of 2,000 MW, the generation fluctuates by almost 400 MW within 60 minute and 200 MW in a 15-minute duration. At present, the state is able to manage these fluctuations with the available hydro reserves. Large-scale wind and solar power, on the other hand, require quick ramp-up generators and storage devices to offset the variability in generation.
2. **Energy Storage.** At present, pumped hydro is the only cost-effective technology for grid level energy storage regarding the global scenario. Future capacity addition is, however, limited given the ecological concerns with building reservoirs for water storage and the strict geological/geographical requirements for pumped hydro. There is a critical need to develop other cost-effective energy storage options for both grid-connected and off-grid power systems.
3. **Demand response.** Renewable power generation does not coincide with the load curve. Therefore, there is a need for 'management' of the load curve, in particular shifting the peak load. This requires both, strategies for load management and control such as 'demand response' and innovative tariffs such as 'time-of-use' or 'real time pricing'.
4. **Micro-grids .** Decentralized power generation is an important option to pursue. In India, utility-scale generation would take several years to provide quality electricity to consumers, particularly in remote villages. The gradual decline in the price of solar PV makes it possible to envisage decentralized (especially rural) micro grids with energy storage in India.

Research Objective, Thrusts and Novelty: A Way Forward for New India in Energy Sector

Given the scale and interconnected challenges, it is necessary to examine in detail the following options:

- (1) Distributed and grid level energy storage options.
- (2) Smart Grid technology for Renewable Energy Integration and Open Access Market
- (3) Hydrogen Energy Production with Solar Power and Storage for Transportation/ Industrial usage

The research thrusts and objectives at present have several cross-cutting competencies, innovation aspects and themes including materials synthesis and processes for prototype battery fabrication; design and optimization of storage with renewables, modelling and simulation, techno-economic and policy assessment and most importantly, development of a framework for a few pilot projects to demonstrate integration of a renewable energy source with the grid using smart grid and storage options.

Harmonising Productivity and Sustainability-- Role of People and Skills

Veena Swarup

“Don't endanger your Company's future success by failing to nourish top talent.

If you aren't nurturing your high potential employees, you are missing on an opportunity to help boost your bottom line.”... Jill Jusko, Editor Industry Week.

The Energy Sector at heart is a people's Business, with Energy resources in focus on the world stage. Globally the Energy Sector employs the best Engineering and Technical experts and specialists, in view of the urgent need to develop technologies and new way of thinking. Years of experience of these specialists and technicians is harnessed to boost productivity of existing resources and develop new resources. This Sector needs to essentially maintain skill level and attract new talent.

People and Skills are key to Sustainability and Productivity of an Organisation, where Sustainable Productivity is about maintaining the balance of the needs of the Employees, the Environment and those of the Organisation at large, leading to continuous Business growth and at the same time high levels of Employee Well being and Environment Management.

The key differentiator for an Organisation is its people, For effective Organisations to maintain high Productivity and Sustainability, its imperative to have an effective HR Strategy aligned with the Business Strategy, well crafted talent management processes, including for Skilling and Development, since Talent drives Business and Skills fuel Talent.

Whereas Business Strategy, the hardware, drives future Organisations, Values led and purpose driven HR practices, the software, must drive sustainable and responsible growth. So as may be seen, HR is at centre stage for progressing or developed Organisations, high in both Productivity and Sustainability. People being a critical Resource it's important to keep a focus on their Aspirations, through their desire for responsibilities, challenges, and rewards, entailed by senior roles, their Ability and through Engagement with them.

The Energy Sector has the most unprecedented changes and challenges in the Industry. Some of the common Disruptions being:

- Changing Geopolitical Relationships as an impact of Globalisation
- Disruptions in existing Business Models due to changing Business scenarios world over such as Brexit etc
- Increased Competitors
- Changes in supply and demand dynamics
- Demographic shifts such as availability of youth, ageing population or migration of workforce
- Social and environmental pressures
- Rise of exponential technologies

Being aware of the impact of fast rising exponential technologies, there was a focus on gearing up for Industry 4.0, when suddenly everything was out of gear with the onset of the unprecedented Covid-19. The New Normal was work from home, social distancing, multitasking and digitalisation. Every Industry, including Energy, was affected, and brought out the urgent need for display of effective leadership, empathy, resilience, agility which were crucial to bring back the momentum of Organisational activity and sustain it with high productivity amidst all kinds of challenges such as lock downs and mental health issues amongst teams. The future of work changed abruptly. The fact that People are at the heart of any Business including Energy could not have been understood better.

Energy Sector needs to focus in a large way on multiple actions to meet the challenges and achieve desired results:

- Effective Skilling to meet the multitasking needs
- Effective Up- Skilling & Re- Skilling to keep pace with changing needs
- Redefining of Job Roles
- Redrafting the Standard Operating Processes (SOP's)
- Review of Skilling Curriculum
- Review the Skill Gaps Studies
- leverage Gig and Platform Workers
- Impetus to Entrepreneurship
- Focus on Traditional Clusters for certain jobs

A Ficci Study in August 2021 on Skills and Jobs --A pre and post Covid perspective, highlights a Global shift in workforce and workplace transition, where it defines Shifts in Work, Workforce & Work place as follows:

- Work -- focus to shift on investments towards Automation & Cognitive Technology
- Workforce-- important to look at alternative work force models and leverage on Gig Workers to the extent possible
- Work place - to be hybrid-- physical and remote.

Managements need to review the Employee related policies and be innovative to have the right resources.

Shifts in Key Skills Post Covid highlighted by the Study are Data literacy, Digital & Coding Skills, Critical Thinking, Creativity & Innovation and know how of Technologies such as Artificial Intelligence, Big Data, Internet of Things, Robotics etc that will make Businesses more resilient. These Skills along with domain specialisation are as relevant in the Energy Sector as any other Sector. There is hence a growing need to Skill, reskill, and upskill existing and new workers through Skill Development programmes.

In the recent years Government of India has given a great impetus to the Skilling ecosystem through setting up a Ministry for Skill Development & entrepreneurship, with a view to be able to enhance employability by Skilling of youth and school drop outs and making them ready for job opportunities. The Government Skilling initiatives include several funding schemes for different levels such as at University, below graduation and school drop outs. Besides the Central schemes there are special Skilling schemes through various Ministeries and Departments, States Skill Missions and other such agencies. Many Corporates are also promoting Skill Development through their Training infrastructure or as part of their CSR initiatives.

In view of the importance of Workforce and Skills and their complexities in the Energy Sector, it is imperative to have the right people for the job roles. Building the Foundation through people is a critical activity for all Organisations more so in the Energy Sector which has largely the pool of Engineers and Specialists. I recall in all the Organisations I was in, this was a very important area to carefully build the foundation for selection of Resources, which are like gems, who are the wealth of the Organisation and will steer the Organisation further to great heights -- ONGC, (upstream Oil & Gas), MRPL (Down Stream-- Refiner), and EIL (consultancy-from Concept to Commissioning in the Energy Sector).

The process to be followed included:

- Role Analysis on a KSA Framework (knowledge, skills, attitude)
- Identification of critical roles through interactions with experts
- Align roles to Organisations Vision and Business Strategy
- Identification of key stake holders for development of critical role profiles
- Identification of technical, functional and behavioural competencies
- Identification of the Orientation programmes

- Developing Career paths & Development plans for those inducted
- hand holding and mentoring at different stages.

It is important that the workforce built is Agile, where teams can handle any changes to be able to meet the challenges of new opportunities through diversification. For example a team of chemical engineers have been hired for a design and structure department and if the requirement comes up later to diversify into areas of renewable energy ,or some water projects, the team should exhibit talent fungibility. Skilling and Re-Skilling should make them ready for the change. Special care is important to ensure capacity building of trainers too, by harnessing the knowledge of experienced Specialists and Technicians. Rotational training and job rotation can also be looked at as a part of the Career Development Policy, to give sufficient exposure to various areas and spheres of work and challenges.

Another area towards having a skilled robust workforce, is through Collaborations-- within the country or globally, with Organisations or Academia. This could be through contracts or MOUs. Such collaborations for capacity building or research could be through specific strategies. Such initiatives are a great step towards joint setting of curriculum, so getting Industry ready talent, specialised capacity building, better result oriented research and even giving impetus to transfer of technologies-- research put to use. There are many examples of successful collaborations in the Oil & Gas Sector and the Energy Sector at large.

Challenges will keep increasing with people having greater aspirations and opportunities showing up. Future Organisations will evolve on Process Excellence, Purpose driven Culture, Design thinking being key to making best products, State of art Adaptive Technologies, Agile Teams, Top driven through Effective Leadership.

Adaptive , Agile and Resilient Organisations will survive the fast moving changes and global shifts, and continue to exhibit Productivity and Sustainability.

Productivity Improvement through Green Productivity

Dr. Anil Kumar Saxena

1.0 Introduction

Productivity is one of the factors considered for economic development of any nation. The increase in the production was considered as productivity improvement by increasing the inputs. Labour productivity was considered by economists while discussing about productivity as the amount of product produced by each unit of labour. Later on, it was realised that labour is not only the factor for productivity but also the other input resources are also important to improve the productivity. All inputs contribute to the productivity of a business which include labour, machinery, land, raw materials and human capital. In the earlier days, the natural resources were utilized liberally in view of easy availability resulting in fast depletion with the growing demand of ever-growing population. It may be noted that the natural resources are not unlimited and the businesses have to utilize these resources judiciously and take into account other resource inputs while calculating productivity.

A country that has a higher level of productivity than another one is able to produce more with the same amount of inputs and is thus comparatively more competitive. In contrast, countries with higher productivity growth experience larger relative increases in their output than those with lower productivity growth rates. One can see that the contribution of different factors of production to growth varies across countries due to differences in inputs, such as labour and capital and total factor productivity (TFP). Economic growth can also take place when firms are able to increase levels of output by using existing inputs more efficiently and effectively. A nation that has a higher level of productivity is able to produce more with the same amount of inputs and is comparatively more competitive. Productivity, in a broad sense, is a measure of how efficiently and effectively resources are used as inputs to produce products and services needed by society.

Any form of economic activity, be it agriculture, industry or the services sector, involves use of natural resources which is increasing rapidly, coupled with population growth. The process of utilizing these resources results in degradation of the environment. It is now recognized fact that production and consumption patterns have become unsustainable which has led to severe, and in many cases, irreversible deterioration of the environment. There is a need to change strategy for economic activity in order to conserve the natural resources to protect the environment. Therefore, resource utilization needs to be made more efficient. Manufacturing processes, which consume maximum resources, result in pollution in the form of air emissions, wastewater and solid waste generation which will impact air, water, land and associated biota. Also, the use and disposal of products by consumers again results in pollution of air, water and land.

Increasing awareness and growing public concern about the negative impacts of agriculture, industry and services on natural resources is forcing a rethinking of the strategy for growth and economic development.

By the late 20th century, the concept of sustainable development became important for the growth of a nation. The sustainable development was discussed first at Rio Earth Summit in 1992 by the leaders and Agenda 21 was passed for sustainable development. It was decided that investing in sustainable development goal will foster productivity growth. There is a correlation between productivity improvement with sustainable development and government policies which directly and indirectly affects the economic growth of a nation. The social policies of the any nation contribute in expanding education, health and other basic infrastructure systems. On the other hand, economic and sectoral policies of government may strengthen productivity by promoting sustainable industrialization through reducing waste

generation at source by using pollution prevention, waste minimization, cleaner production and pollution control techniques & technologies. This would ultimately lead to sustainable development. Figure 1 shows relationship between Government policies with productivity and sustainable development.

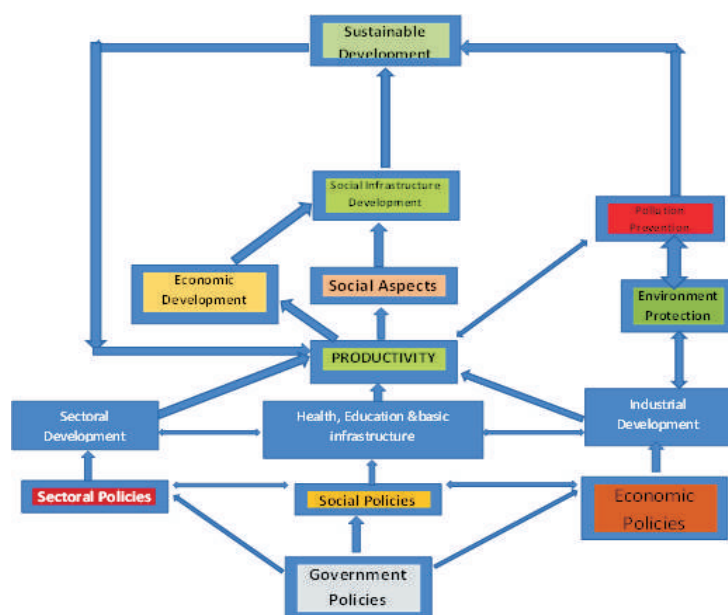


Figure - 1: Framework for Networking between Social, Economic, Productivity and Sustainable Development

Economic liberalization in India has led to rapid growth in export-oriented industries, urbanization, construction boom in late nineties. From an economic perspective, both trade liberalization and environmental protection are inherently important and interlinked. There is a need to combine both these aspects to promote sustainable economic development

"Environment and development are not separate challenges; they are inexorably linked. Development cannot subsist upon a deteriorating environmental resource base; the environment cannot be protected when growth leaves out of account the costs of environmental destruction. They are linked in a complex system of cause and effect."

The important point to be noted here is that the rate at which resources are extracted must be at slower rate than that the rate at which they are replenished by natural processes. This is the core or the essence of sustainable development. Our Common Future, The World Commission on Environment and Development,

1.1 Importance of SMEs

Small & Medium Enterprises (SMEs) are the backbone of economic development and engine of growth, particularly in Asian countries. These industries constitute more than 50% of the total industrial sector output in China and India, and for 10% - 25% in most other Asian countries. The importance and dynamism of SMEs is one of the distinguishing features of the industrial sector in Asian countries. They are the important source of employment for low income earners, thus helping to alleviate poverty.

Pollution is a form of a waste and a symptom of inefficiency in industrial production.

SMEs on the contrary have limited resources at their disposal - both technical & financial and often find themselves unable to afford address the changes, in their system, necessary to meet fast changing environmental regulations and product quality. They pose difficult pollution abatement problems because of complexity of pollution potential. Though, they are not the major polluters in most sub-sectors, but generally their pollution potential is more per unit of output than large firms operating in the same sector.

1.2 Productivity and Environment Management

Industry is central to the economies of modern societies and an indispensable vehicle of growth for any nation. Industry has an impact on the natural resource base throughout the entire cycle, from raw material exploration and extraction to product use and disposal. These impacts may be both positive by enhancing the quality of life and also negative in the form of pollution and depletion/degradation of resources which may happen both during the manufacture of goods and services as well as during their use and disposal. In most of the nations, the excess fertilizers and pesticides are being used in agriculture sector. Thus, impacting the soil and water resources. The concept of economic development has to be looked differently in view of increasing awareness and growing public concern about the negative impacts of agriculture, industry and services on natural resources.

Earlier the society was market driven however after liberalization of industrial policy in nineties in India, it has become consumer driven due to availability of variety of competitive products. A knowledgeable consumer drives producer to be more responsible and accountable. In the changed scenario, communication plays a major role in driving development towards a sustainable path.

No business can long operate forever by depleting the natural environment. Hence in order to sustain growth for any nation, it is important to address both the quality product and environment conservation. The World Council of Environment and Development (WCED) addressed these issues and provided definition of **"Sustainable Development"** in his book entitled **"Our Common Future"** in 1987 as ***"development that meets the needs of the present generation without compromising the ability of the future generations to meet their needs."*** World Business Council of Sustainable Development (WBCSD) coined the term **"Eco-efficiency"** and first introduced as a concept in 1992 in Changing Course at the Rio 'Earth Summit'. The trend of 'Environment Management' has changed since 1950's from ignorance to dilution (1960's) to pollution control & prevention (70's & 80's) and now to eco sustainability through Green Productivity.

"By considering pollution prevention separately from other manufacturing needs such as productivity and quality improvements, most pollution prevention programs fail to develop the vital synergies and working relationships with manufacturers that are essential to drive both pollution prevention and manufacturing competitiveness....."

Industry, Technology and the Environment -- Competitive Challenges and Business Opportunities. The US Congress, Office of Technology, January, 1994

1.3 Integration of Environment and Productivity

Traditionally, productivity improvement focused on cost effectiveness through cost reduction. Therefore, to improve profitability or organizational effectiveness, the approach used was cost reduction. With the advent of "the quality" drive, productivity had to be measured by comparing the benefits accrued from a quality program (output) with the resources used within the programs (inputs). To some extent, productivity practices such as preventive maintenance and good housekeeping reduce the environmental burden. However, for total environment management, it is necessary to integrate these productivity improvement programs. Thus, the environment is the ultimate foundation for business and economic productivity. By the onset of early nineties, environment became one of the important factors while assessing the productivity. The integration of environment with productivity is shown in Figure 2.

The total quality movement may be one vehicle through which environmental issues can be integrated into business as a whole.



Figure - 2: - Integration of Environment in Productivity

2.0 Evolution of Green Productivity

No business can long operate without a profit. A business that loses money will eventually drain the resources of its society. No business can also not operate forever by degrading the natural environment. The environment is the ultimate foundation for business and economic productivity. The earth provides huge resource bank from where we can withdraw and spend. However, this resource bank is not unlimited. Everyone pays for earth's resources as per their cost of extraction and not their cost of creation. It takes millions of years to create resources however, it will not take time to deplete these resources, if not used judiciously. If it is not replenished, the ATM of resources bank will become bankrupt. It is therefore, businesses should track the environmental resources it consumes - and take responsibility for their replenishment.

There are sufficient resources for the need of everyone however, not for the greed of person.

Mahatma Gandhi

The need to fundamentally change the approach to business by moving towards resource efficiency and taking a holistic life-cycle view of products was recognized in the 1990s. Resource efficiency not only leads to protection of natural resources, but also results in improved productivity. Therefore, if development is to be sustainable, there is a need to move beyond pollution prevention and ensure that both productivity improvement and environmental protection are achieved simultaneously.

Rio Earth Summit in 1992 addressed Sustainable Development to conserve natural resources. Asian Productivity Organization (APO) took the initiative and formalized the concept of integrating resource conservation with productivity and coined the term "Green Productivity" in 1994.

2.1 Concept of Green Productivity (GP)

Green Productivity (GP) reconciles two needs that are often in conflict that is the need for business to earn a profit and the need for everyone to protect the environment. **Green Productivity (GP) is a strategy for enhancing a business's productivity and environmental performance at the same time, for overall socio-economic development (Figure 3).** It is the application of appropriate techniques, technologies, and management systems to produce environmentally compatible goods and services. GP acts as a catalyst for moving two wheels of development i.e., productivity improvement and environment protection.

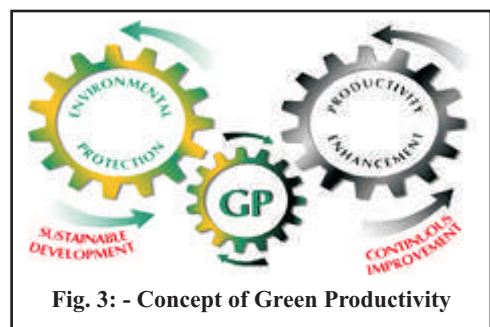


Fig. 3: - Concept of Green Productivity

GP has two "silver bullets" - Productivity Enhancement and Environment Protection. It enables us to do more and use

less. **"Doing more" is a function of innovation.** Designer William McDonough calls that eco-effectiveness. "Using less" is a function of efficiency - or what environmentalists call eco-efficiency. GP puts them together. Green Productivity is part of a much broader movement of change that goes by many names - natural capitalism, corporate sustainability, industrial ecology, and others. Green Productivity is a system popular in Asia that combines the tools of productivity enhancement with insights from nature to deliver gains in each. The productivity tools used are Just-in-time, inventory management, source reduction, dematerialization, and environmental design.

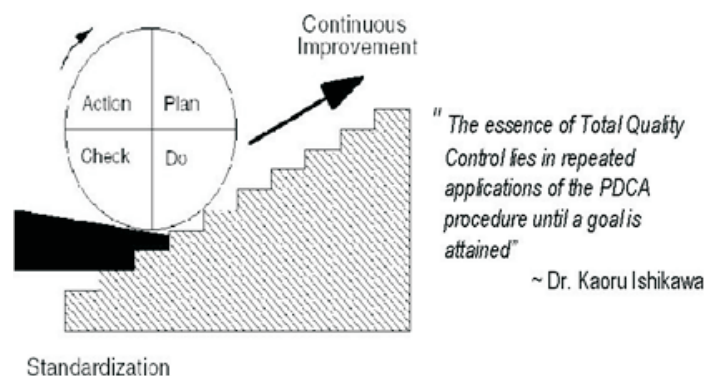
The goal of GP is to attain a higher level of productivity to serve the needs of society, and to protect and enhance the quality of environment - both locally and globally. GP and eco-efficiency share a common vision. GP, however, looks at environment and productivity in an integrated manner to form the foundation of sustainability, considering the harmony needed between production as well as consumption.

GP recognizes that all the pollution and waste generated are the wasted resources which is not able to convert resources into saleable products. From this perspective, pollution and waste are the inverse of corporate productivity. GP seeks to eliminate this process inefficiency - pollution and waste. It also sets out to promote innovations that create new valuable products or processes. In these two ways - reducing waste and increasing innovation - GP helps a company increase productivity.

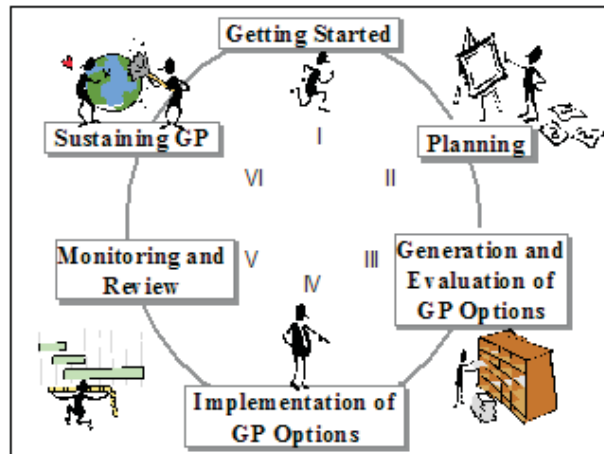
2.2 GP Methodology

There is a step-by-step problem-solving framework developed by the APO for GP. GP methodology was developed originally to solve environmental and technical problems in the manufacturing industry which is based on **Deming's Cycle** i.e., 'Plan-Do-Check-Act' (PDCA) as shown in Figure 4.

Figure - 4: PDCA Cycle for Continual Improvement.



GP methodology has three components i.e.; (1) the step-by-step problem solving framework, (2) the set of tools, techniques and methodologies used in conjunction with the frame-work, and (3) The social, economic, environmental and cultural principles and values that govern the choice of tools, techniques and technologies and the design of the GP process. The problem-solving framework, in one form or another, is widely used in many organizations and enterprises. APO implemented and tested this framework in a number of Green Productivity Demonstration Projects (GPDs) in different APO member countries and developed a 6-step approach with 13 tasks (Figure 5). The methodology used in GP were none other than productivity tools & techniques.



6 Steps & 13 Tasks of GP Methodology

GP methodology consists of six major steps. A step can be completed by following certain tasks. The six steps of GP methodology consist of thirteen tasks.

Step I: Getting Started

- Task 1 Team formation
- Task 2 Walk through survey and information collection

Step II: Planning

- Task 3 Identification of problems and causes
- Task 4 Setting objectives and targets

Step III: Generation, Evaluation and Prioritization of GP Options

- Task 5 Generation of GP options
- Task 6 Screening, evaluation and prioritization of GP options
- Task 7 Formulation of GP implementation plan

Step IV: Implementation of GP Options

- Task 8 Implementation of selected options
- Task 9 Training, awareness building and developing competence

Step V: Monitoring and Review Task 10 Monitoring and evaluation of results

- Task 11 Management review

Step VI: Sustaining GP

- Task 12 Incorporating changes into organization's system of management
- Task 13 Identifying new/ additional problem areas for continuous improvement.

2.3 How to implement and measure Green Productivity?

The core metric of the industrial economy, where information multiplies resources of all kinds is total resource productivity: labour, capital, land, raw material, water and energy. That means all inputs into production have to be used with the aim of obtaining the greatest possible output with the least possible input use. There are many ways to measure resource productivity or key components of resource utilization/productivity. There are many ways to express resource productivity depending on the professional background and skill. It is important for any establishment be it a society, industry or service sector to find out the root cause of the problem of inefficiency leading to non-productivity.

There are a number of tools & techniques available to measure productivity. However, one of the important tools is a Cause-Effect diagram also called as Fish-bone diagram because of its appearance, where head of fish represents the core problem (Figure 6). This is also known as an Ishikawa diagram after the man who popularized it in Japan. The

principle of this cause-effect analysis is based on "**Four M**" indicating that any problem may happen because of Man, Material, Machine and Method. The Cause and Effect analysis helps one to:

- Focus attention on a specific problem.
- Organize and display theories about its root causes.
- Show the relationship of factors that influence a problem.
- Focus your team on causes, not symptoms.

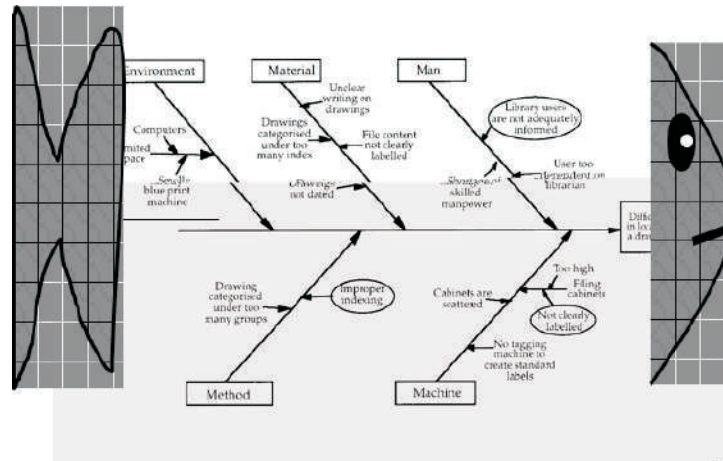


Figure - 6: Fish bone diagram for Problem Analysis.

While doing cause and effect analysis one should remember to:

- identify causes and not solutions.
- causes that appear repeatedly.
- Identify and review each major cause category and highlight the most likely causes on the diagram.
- verify the most likely cause with data.

2.4 Prioritizing Problem Areas

Each organization has to develop criteria for prioritizing areas according to their business requirement. However, the primary criteria for prioritization could be:

- **Severity of the problem** - this refers to the scale and implications of the problem.
- **Frequency** - this indicates the recurrences of the problem. An insignificant problem repeating several times in a production cycle can cause greater damage than a severe problem once in five years.
- **Cost implications** - cost information of the possible solution is needed so as to check the affordability before setting an objective.
- Lastly, but most importantly, the **estimated cost of inaction** - this is the cost of not taking any action on a problem. This is estimated by costing the waste streams.

The scores can be decided by the mutual consensus of the group and a final score, based on the integration of the above parameters, would compare the problems on a macro-level and help in setting the objectives and targets. After identifying the problems and their causes, the next essential input for setting objectives and targets is costs of waste streams, including resources (raw materials / products/ by-products). In simple terms this cost is the cost of inaction.

The businessmen understand the financial aspects very easily. They can be made aware about environmental issues in

terms of costs. In order to determine the monetary losses due to the generation of wastes, it is important to assign costs to the waste stream. While the detailed analysis of the streams provides data for identification of problems that then leads to the cause analysis, the cost assignment provides a basis for generation of viable options.

Such a strategy helps in prioritizing which areas need to be tackled first and what types of options need to be looked at for not only resource conservation but also cost reduction which will ultimately lead to environment protection. The assigning cost to waste streams can be used at several points in the GP methodology viz.; identification and prioritization of problems, setting objectives and in monitoring/corrective action.

We often think of waste as Generally, the physical things like materials, water, electricity, etc. are considered as waste. However, in the context of productivity, waste is defined as any form of work which does not add value to the final output. Some of the companies in Japan for example The Toyota Production System has defined waste as 7 Wastes to include things like excessive stocks, waiting, movement or transport as below:

The 7 Wastes can be used as a guide while identifying area for improvement.

- | | | | |
|---|-----------------------|---|---|
| - | Waiting | : | Leaving resources waiting during production; |
| - | Transporting | : | Moving materials unnecessarily in the factory; |
| - | Processing | : | Wastes inherent in the process or design itself; |
| - | Inventory | : | keeping high inventory or work-in-process (WIP); |
| - | Motions | : | Unnecessary movements of the worker during operation; |
| - | Defects | : | Producing defective parts or poor service; |
| - | Overproduction | : | Produce more than what is needed. |

2.5 GP Barriers

First and the foremost requirement for implementing GP is the commitment. The top management plays a critical role in the success of the GP Program. It has to ensure that the GP program is established by incorporating appropriate changes into organization's system of management to enable continuous improvement. It may be noted that this is not a work of a single person and it is a team effort. There are many hurdles in implementing GP in any organization. There are a number of barriers for implementation which can be categorized as below:

- Attitudinal barriers;
- Information related barriers;
- Technical barriers; and
- Financial barriers.

Resistance to change is one of the most common attitudes observed at every stage, particularly among SMEs. Fear of the unknown and fear of failure are the primary reasons for such an attitude. In most of the family-run SMEs, good housekeeping and management of environmental issues are generally considered as a low priority as compared to the business operations. A common myth in most of the organizations is that efforts on environmental management are expensive with no accrual of financial benefits. However, it has been observed and demonstrated under GDPs in various APO member countries that by just changing some housekeeping practices, may result in considerable resource conservation leading not only to environment conservation but also productivity improvement.

Good housekeeping refers to a number of practical measures based on common sense that organizations can undertake to improve their productivity, obtain cost savings and reduce the environmental impact of their operations. Good housekeeping is more of a habit than a technique which is aimed at:

- Rationalizing the use of raw materials, water and energy inputs;
- Reducing the volume and/or toxicity of waste, wastewater and emissions related to production;
- Conserving material and energy;
- Improving working conditions and occupational safety.

The good housekeeping practices normally do not require significant investment. It is mostly the application of common sense.

3.0 Journey of Green Productivity

The journey of Green Productivity started in 1994 with the establishment of Working Group on Productivity & Environment to conduct research in ten Asian countries. Initially, the focus was on application of cleaner production techniques which subsequently broaden to incorporate more productivity & environmental tools & techniques, including pollution control and target mostly on SMEs which was the backbone of economic development of developing nations. The concept was also extended to farms and community level for socio-economic development of villages, in Vietnam.

India in association with APO has been involved in GP movement since its beginning. National Productivity Council of India has been active in GP Demonstration Projects in industrial and service sector since 1995-96 and also capacity building on GP in various APO member countries.

Manila Declaration on GP was made during the World Conference on GP in 1996 at Manila. Realizing the knowledge base in Japan, APO founded the GPAC in 2003 in cooperation with leading Japanese companies. GP received wider publicity from the Eco-products International Fairs which was initiated in 2004. Since then, these fairs are being organized in APO member countries.

3.1 The major milestones in GP journey are

- 1994: Establishment of Working Group on Productivity & Environment
- 1996: Manila Declaration
- 1996 & 2002: World Conference on Green Productivity
- 2002: Presented Achievements of GP activities in the World Summit on Sustainable Development in Johannesburg
- 2003: Establishment of GPAC
- 2004: Launched Eco-product International Fair & Publication of Eco-product Directory
- 2006: Launched E- learning program

3.2 Achievements of GP

During the course of more than 25 years of launching of GP program by APO, the businesses, farms & community have contributed to the cause of Sustainable Development by improving their efficiencies and protecting the environment in Asia-Pacific region, with or without the support of APO. Some of the major highlights are given below:

- Policy Intervention:** The countries like Malaysia, Thailand & Singapore have incorporated GP concept in their National Development Plans.

- ii) Malaysia established "**International Green Purchasing Network**" in collaboration with the Japanese Government.
- iii) **Capacity Building:** The capacity building programs, on various aspects of energy & environment, were initiated by APO to develop knowledge base not only amongst the business enterprises, administrators, professionals, regulatory bodies, etc. but also the NPOs through short term & long-term training programs, workshop-cum-seminar, GPDP, etc. More than 4500 professionals have been trained so far on GP.
- iv) **GPDP:** Seeing is the believing was the basis for GP demonstration projects. The demo projects have been the instrumental in accepting the GP concept by the industrial units and community. These demo projects resulted in cascading impacts on environment protection & productivity enhancement in a number of industries in the APO member countries.
- v) **EPIF:** About more than 500,000 people have benefited through the Eco-product International Fairs organized since 2004. APO has brought out eco-product directories based on the exhibitors display & their profiles.

4.0 Way Forward:

GP is an umbrella concept covering a hierarchy of improvement opportunity. GP fosters the change process to help businesses not only to cater to the customer need for better environmentally safe products but also to improve their bottom line by conserving natural resources through improved production efficiency. With the growing concern of general public for the demand of "Green & Environmentally Friendly Goods & Services", the concept of GP can turn table round.

Green Productivity has brought substantial & tangible results during the course of its journey since 1994. The APO has contributed towards realizing the goals of Agenda 21 by bringing sustainability in the Asia-Pacific region by the application of GP. The APO will continue its efforts towards sustainable development not only in the Asia-Pacific region but also would like to extend other part of the World through international collaboration. The message is loud and clear, promote Green Productivity as a simple strategy to innovate sustainability for economical, environmental and social (triple bottom line) returns and poverty alleviation.

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WAPS Knowledge Sharing Forums - A Summary

Dr Sunil Abrol

World Academy of Productivity Science (WAPS) has been organizing every quarter panel discussions with subject matter experts across Globe to deliberate on various themes linked to UN sustainable Development Goals. These virtual panel discussions are organized at WAPS Knowledge Sharing Forum (KSF). KSF events are organized by WAPS team comprising of Ms. Anita Tang (USA), Dr Sunil Abrol (India) and Remi Dario (Nigeria).

In all the three events held so far , Mr. Remi Dario acted as the Anchor and Moderator and welcomed the speakers and participants. He set the theme for the day's discussion and introduced the speakers to the audience. Dr Sunil Abrol welcomed one and all for sparing their time for the event and gave an overview of WCPS and WAPS and their activities aimed at promotion and development of productivity movement across Globe. Ms Anita Tang thanked all speakers and participants at the close of the events and summarized the key message shared by three speakers.

The first Knowledge Sharing Forum was held on September, 17, 2022 on the theme " Productivity Strategies for Achieving Sustainable Development Goals ". Dr Arun Kumar Rath, Former Secretary, Govt. of India, Ms. Detoun Ogwo, Development and HR practioner Nigeria , and Dr. Gaspare Manos, Co-founder, Adtones Ltd., UK, were the panelists.

The views shared by the three panelists are summarized below :

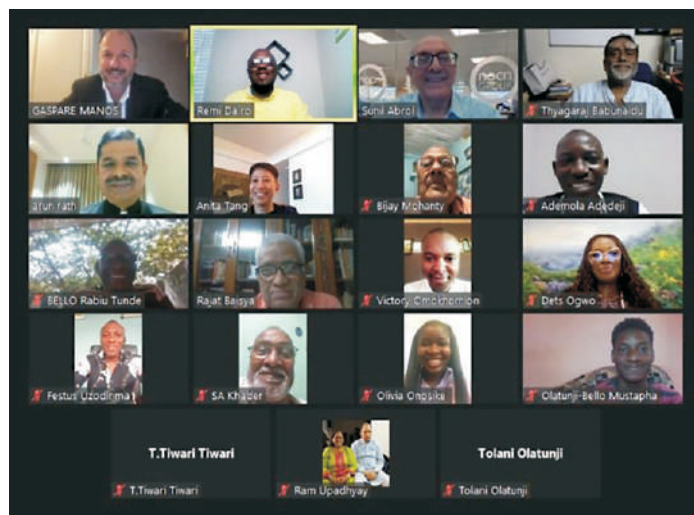
Dr Arun Kumar Rath :

- Economic growth and productivity are intrinsically linked.
- Development to focus on Economic sustainable development, Environment, Reduction in Risks and Hazards and Social-Community participation.
- COVID 19 whipped off 4 yrs of poverty eradication.
- 100 million people migrated due to COVID 19.
- Wages have become stagnant since COVID 19.
- Need for Social Security for one and all.
- Business corporations need to be more responsible to society.
- Climate change challenges caused by Green House effect need attention.
- Principles of Economic, Social and Governance (ESG) need focus for sustainable development.
- Need for local laws and their enforcement besides commitment of the Govt.
- ESG criteria to be followed by all nations.
- Need to phase down use of coal.
- Need to develop carbon credit economy.
- Civil Society to advocate sustainable development.
- Need to de incentivize excessive use and consumption of energy.

Ms. Detoun Ogwo :

- Nigeria has challenges related to Education, Poverty, Health , employment etc.
- Challenge of output per worker vs quality of life of average citizen.
- We need to have bias for action.
- Need for economic transformation both in public and private sectors.

- National productivity low despite great planning documents.
- Need for benchmarking to leap frog .
- Need for continuous monitoring and improvement.
- Need for self introspection to identify areas for improvement.
- Need for evidence based planning for achieving SDG's.
- Everyone to understand need for productivity at individual and national level.



Dr Gaspare Manos :

- Need to link productivity with sustainable development.
- Productivity works better when linked to community.
- Bye in of people necessary for achieving productivity.
- Productivity increases with linkages with Economic, Social Environmental fields.
- Cheaper and faster is receipt for disaster.
- Biggest challenge for Sustainable development goals is , Who pays for it.?
- Need to use Social media for dissemination of SDG message.
- Mobile phones can be great tool for reaching out to the last man.
- Productivity is linked to Finance and politics.
- Public policy has great role in achieving SDG's.

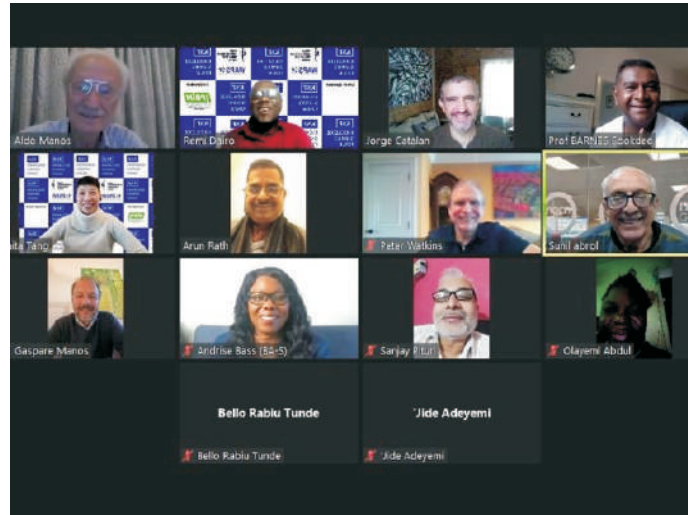
The second Knowledge Sharing Forum was held on December, 8, 2022 on the theme " Climate change- implications for you and me ". Mr. Jorge Catalan, Leader in organic food movement ,Mexico, Dr Andrise Bass,Chair, Humanitarian Focus Foundation, Kenya/ USA, and Dr Aldo Manos, Climate change expert, Italy/Kenya, were the panelists.

The views shared by the three panelists are summarized below :

Mr. Jorge Catalan :

- Do local but Global
- We may not be able to live where we live today.
- Manufacturers of plastic bottle and huge CO2 are sponsors of COP27.
- 37% of Global energy consumed by Agriculture sector.
- Need to follow sustainable development practices in agriculture sector.

- Do not fight with nature
- Focus n Bio diversity.
- We care for oil and not soil
- Need for soil protection. Avoid insecticides.
- Use local produce and seasonal produce to reduce consumption of oil and refrigeration.



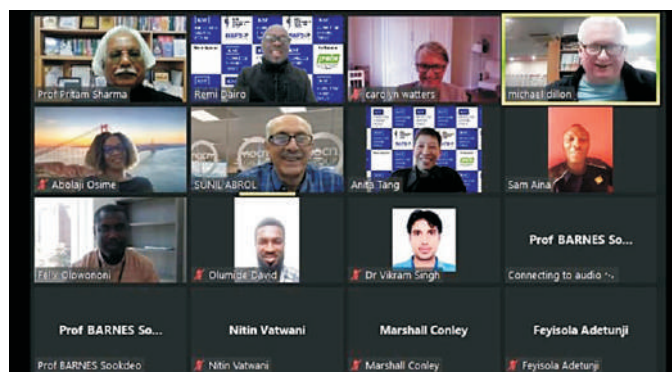
Ms. Andrise Bass :

- Human action causing climate change
- There is not enough action towards climate change.
- Climate change is a Human Right.
- Floods destroy humanity .
- Countries do not have plans or budget for climate impact events.
- Collaboration is the way forward
- All of us guilty of climate change
- Solutions today are too small
- People to take action their level without waiting for Govt. support and initiative.
- Action required towards food security, trafficking , migration and health care.

Dr Aldo Manos :

- Need to change Gross Domestic Production to Gross Domestic Pollution as a measure of economic development of nations.
- Focus on job creation leading to pollution.
- Lack of understanding between technology and society.
- Scientists should stay in labs and not influence public policy.
- Gap in what we know and what we do.
- We have reached tipping point.
- We are speeding down highway to death.
- Future of earth is in danger.
- People should elect politicians who will save both earth and jobs.
- Innovations in mobile technologies can be used to communicate with people need for saving earth.

Third in the series KSF panel discussion was held on the theme "Making Education Vocational for Greater Employability". Ms. Abolaji Osime, CEO and owner Global International College, Nigeria, Prof. P.B. Sharma, Vice Chancellor, Amity University India and Dr Carolyn Watters, Professor Emeritus, Dalhousie University, Canada were the panelists.



The views shared by the three panelists are summarized below :

Ms. Abolaji Osime :

- Need for industry involvement in education
- There is lack of internship opportunities for students
- Need to connect students to the world of work
- Teachers Faculty need to be trained to impart skills to students
- Skills need to be made aspirational for students to become employable
- Need for making education blended -both hands on and contextual
- Curriculum to be modified to make it competency based
- Need for Career Coaching for students
- Introduce Project based learning for all disciplines
- Give students creativity skills
- Educational institutes to focus on demand side
- Education to focus on future needs

Prof. P.B. Sharma :

- Education need not focus on employability
- Education for Peace, Harmony , Sustainability and Well Being
- Education to make students Future ready
- Students need to learn Personal skills
- Focus of education should be to make students outstanding human beings
- Skilling for connecting to world of work and future challenges
- Learning by doing should be the mantra
- Need for mass entrepreneurship
- Learning to focus on knowing and how to apply
- Education to go beyond STEAM(Science, Technology, Engineering, Arts and Mathematics).

Dr. Carolyn Watters :

- Need for personal development and focus on skills in education
- Preference should be for self employment against jobs
- Set up more community colleges
- Introduce Apprenticeship in all courses
- Need for re/ up skilling of work force to make them employable
- Search for future employability skills for changes in curriculum
- On line learning to boost reach- overcome credibility challenge
- Need to develop ecosystem for credits for on the job learning
- Create pathways for those who do not have qualifications
- Need for National strategy for credit transfer
- Need for collaboration between Academia, industry Society and Govt.
- Introduce Learning Management Information Systems
- Integrate ICT in learning
- Reduce duration of courses / Micro learning.

Panel discussions followed by questions from the moderator, and audience.

Harmonizing Productivity with Sustainable Development

By Dr Arun Kumar Rath

Productivity is crucial to economic growth. While enhancing productivity, it is imperative to ensure sustainable development in all sectors of the economy. It is increasingly being realised that the process of development must protect the environment and safeguard the interests of society. Development must be built on the three pillars of productivity, namely economic growth, ecological balance and social progress.

Productivity needs to be linked to sustainable development with the following evaluation criteria :

- " The products, processes and services must be environmentally sound .
- " Integration of sustainable development and economic growth.
- " Reduction of risk and damage to nature.
- " Social approval for development

It is necessary to build a just society ,better environment , peace and prosperity for all sections of the community. However, the path is fraught with enormous challenges of harmonising the economy with society and environment. Our development efforts must be complemented by sustainable technological innovations to achieve long term values.

Sustainable Development

World Commission on Environment and Development set up by the United Nations, in their report of 1987, defined sustainable development as "development that seeks to meet the needs of the present without compromising the ability of the future generations to meet their own needs . " This objective of achieving sustainable development is a challenge by itself. It casts a stupendous ethical responsibility on the present generation to accept its role of planning , provisioning and even sacrificing for the unborn generations of future times. The litmus test of all our activities of should be guided by two cardinal principles of action, namely causing least harm to nature and working for long term benefits to all living beings on the planet earth.

Development must balance social, economic and environmental sustainability. It must follow the vision of all nations of the world as enshrined in the UN resolution concerning sustainable development goals. A set of seventeen goals were adopted by the United Nations in 2015 to be achieved by 2030. It was a call for action to end poverty & hunger , ensure gender equity, protect the planet, and ensure that by 2030 all people enjoy peace and prosperity and live in a just social order all over the world. The SDGs are No Poverty ,Zero Hunger ,Good Health and Well-being ,Quality Education ,Gender Equality ,Clean Water and Sanitation ,Affordable and Clean Energy ,Decent Work and Economic Growth ,Industry, Innovation and Infrastructure ,Reduced Inequalities ,Sustainable Cities and Communities ,Responsible Consumption and Production ,Climate Action ,Life Below Water ,Life on Land , Ensuring Peace, Justice and Strong Institutions and Partnerships for the Goals

The then United Nations Secretary-General Ban Ki-moon in 2015 , when asked about his plan B if the plan A fails, aptly stated that "there can be no Plan B, because there is no Planet B." In the words of UN Secretary-General António Guterres, "We must rise higher to rescue the Sustainable Development Goals - and stay true to our promise of a world of peace, dignity and prosperity on a healthy planet."

The COVID pandemic has damaged the achievements of many of the sustainable development goals .The Sustainable Development Goals Report 2022 stated, " The agenda for sustainable development is in grave danger, along with humanity's very own survival. The confluence of crises, dominated by COVID-19, climate change, and conflicts, are creating spin-off impacts on food and nutrition, health, education, the environment, and peace and security, and affecting all the Sustainable Development Goals ". The COVID-19 pandemic wiped out more than four years of

progress on poverty eradication and pushed 93 million more people into extreme poverty in 2020. The pandemic disrupted essential health services. More than 24 million students may never return to school. One quarter of global population live in conflict-affected countries. 100 million people have been forcibly displaced worldwide.

The Ukraine war created one of the largest refugee crises of modern time. Developing countries are battling record inflation, rising interest rates and debt burdens. Therefore all governments of the world, all corporations and business and all communities and institutions must work now, with renewed vigour, to compensate for the loss due to the pandemic and work harder to achieve the goals in the remaining seven years' time.

Social contract in 21st century

Large populations across the world face persistent wage stagnation, work fragility, challenge of affordable housing, rising expense of healthcare and education, multiple pressures on low-income individuals, persistent gender and race. The purpose of a business corporation needs to be redefined in the contemporary times to care and deliver value for the society, environment and all other stakeholders. It is time to adopt a new social contract for the twenty-first century in the lines of the traditional theory of Social Contract, of Jean-Jacques Rousseau. The new social contract should govern the agreement and understanding between individuals and institutions. It must ensure the rights of individuals to secure protection and social security.

Globalization has thrown up new challenges before the business corporations. The profit motive of the business entities are often responsible for the adverse consequences. Adverse impacts are pollution, climate change, threat to environment and biosphere, waste generation, threat to traditional culture and values, fast depletion of earth's resources. As such the SDGs cast great responsibility on the business corporations to be responsible to society and environment. Environmental, Social, and Governance (ESG) Challenges

A global conference, aptly named Who Cares Wins, was organized in 2005 by the United Nations, International Finance Corporation and other global agencies. The Who Cares Wins Conference examined the critical role of environmental, social and governance (ESG) management in sustainable investments. Since then, ESG criteria have become crucial to screen investments with the objective of encouraging companies to act responsibly. Three aspects have implications for sustainable corporate performance.

1. Environmental aspect focuses on preserving the natural world. Examples of concerns addressed include climate change, greenhouse gas emissions, biodiversity loss, deforestation, pollution, energy efficiency and water management.

2. Social aspect focuses on people and relationships and includes gender and diversity, equity, inclusion movements, enhancing customer satisfaction, employee engagement, social concerns and satisfaction of societal needs.

3. Governance must ensure sound corporate governance, shareholders rights, board composition and diversity, management structure, executive compensation and perks, preventing bribery and corruption, cybersecurity practices, effective audit and safeguarding interests of stakeholders.

ESG's three central factors are:

- o Environmental criteria, which examines how a business performs as a steward of our natural environment, focusing on key issues concerning environment
- o Social criteria, which looks at how the company treats people, and concentrates on key social issues
- o Governance criteria, which examines how a corporation polices itself - how the company is governed, and focuses on key issues
- o India's Agenda
- o India is home to one-sixth of the planet's humanity, which makes the country a key player in ensuring the prosperity

and sustainability of the planet and its people. India has raised the levels of prosperity for its people manifold in the recent past. However, challenges remain in many areas including health, nutrition, basic infrastructure, quality of education among others. India is committed to attain SDGs in transforming this country, by improving its socio-economic-environmental indicators. With eight years left to meet the global goals on sustainable development, the country is off-track, the trends indicated.

The gravest challenge to save the planet today comes from Climate change caused mainly due to three factors namely carbon footprint, greenhouse effect and global warming.

Most of the discussions ahead of the COPS26 Summit at Glasgow have revolved around getting all countries to commit to a net-zero target by a specific year. However, India has reportedly rejected calls to announce a net-zero carbon emissions target, keeping in mind that India's per capita carbon emissions per year is 1.96 tonne, while it is 8.4 tonnes for China, 18.6 tonnes for the US, 7.16 tonnes for the European Union 12.5 tonnes for Russia.

A recent report by the Natural Resources Defense Council, a non-profit international environmental advocacy group, with its headquarters in New York City, stated that India was largely on track to meet, and even exceed, its Paris Agreement targets. Nevertheless, India will face considerable pressure from various quarters in the years to come. As a nation we must plan and implement a sound policy and strategy in this regard. India's official position has been presented by our Prime Minister as Panchamrita with five cardinal principles:

- “ First- India will take its non-fossil energy capacity to 500 GW by 2030.
- “ Second- India will meet 50 percent of its energy requirements from renewable energy by 2030.
- “ Third- India will reduce the total projected carbon emissions by one billion tonnes from now till 2030.
- “ Fourth- By 2030, India will reduce the carbon intensity of its economy by less than 45 percent.
- “ Fifth- To achieve the target of Net Zero emission by 2070.

Future Strategy

The leading ESG organization Social Responsible Investing (SRI) reported on 7 August 2021,

"The big picture is that in the next few decades the global economy is going to transform to a low-carbon economy and it will be one of the biggest investment events of our lifetime." "We have a global economy that is roughly \$80trn [£56.3trn] and extremely dependent on carbon, so transitioning to an economy where we are much less dependent on carbon will result in enormous disruption to established industries and geopolitical relationships and how the global economy works. In the next 10-20 years there will be huge risks and opportunities."

In similar lines Unilever's global CEO Alan Jope said (New Delhi 20 Sept 2022 FICCI meeting)

"The estimated disruptions caused by rising temperatures will cost companies \$ 1.3trillion by 2026 and is likely to result in loss of 80 million jobs, stressing there was a need to build sustainable businesses"

The CEO of the multinational consumer goods giant made the remarks while speaking at an event organized by FICCI, "Cost of inaction is far higher than the cost of acting"

We are at the mid point of the 15 year time frame given by UN in 2015 to achieve the SDGs in 15 years. SDGs have so far remained ethical questions without the force of law. It is high time national governments bring legal provisions to enforce the implementation of the global targets. After near failure of COPS 26 at Glasgow, countries should come back at COPS 27 to submit stronger 2030 emissions reduction targets with the aim of closing the gap to limiting global warming to 1.5 degrees. Environmental, social, and governance (ESG) criteria must be used by financial institutes and investors to promote investments which enable sustainable development. Sustainable development requires balancing the social, economic and environmental aspects and build an enduring social order on the planet where not only the human beings but also all life forms live in harmony and peace.

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