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IN PERPETUAL PURSUIT OF HAPPINESS, 'HOLISTIC' WORK SYSTEM DESIGN WILL HELP

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ABSTRACT

In the Perpetual Pursuit of Happiness (PPH) by all, Industrial Engineering perspective-' holistic, and interdisciplinary', Techniques, and approaches, for Designing Work Systems to involve HEAD, HAND, and HEART (3H) in every moment of work and life, will be decisive. This paper intends to explain, 'how and why' with brief exploration of interconnected, 'Work, life, and Happiness, a 'bird's eye survey' of ever- expanding 'Science and Technology, and billions of goods &services in use requiring trillions of Work and 'Work systems' to make them. The paper explores how Industrial Engineers as the WORK SYSTEM DESIGNERS can help boost efficiency, effectiveness and most importantly, add to the HAPPINESS at all work places through involvement of (3H) in Perpetual Pursuit of Perfection (3P).

Keywords: *Happiness, Holistic, Work System Design*

1. WORK, LIFE AND HAPPINESS

All LIVING BEINGS from birth to death are in perpetual pursuit of **HAPPINESS (PPH).**

LIFE and **WORK** are in-separable.

WORK can be physical, mental, emotional, or any combination of the three involving **Hands, Head, and Heart (3H) .**

Thus WORK involving 3H can ensure HAPPY LIFE, for each individual.

Happy Individuals only can create and sustain Happy Families, Communities, Countries, and make the World a happy place for all Beings.

However, in real life, few, if any, individual or other collective from Families to the World are, perpetually, Happy.

Wage earners in fields and Factories view WORK as an inescapable drudgery and look forward to after- work time and holidays for Happy hours and days. Students look forward to weekends and Holidays.

Except few- like passionate Researchers who emerge from their Laboratories dreamy–eyed, asking passer by 'what DAY, (not time) it is?' or Artists and the like, who view time spent in their creative WORK as the HAPPY LIFE, not as mere means of living.

Ofcourse, parents work with love, to raise their children

Few randomly picked examples of WORK for LOVE:

*The voluntary physical House Construction work for the homeless, on behalf of the HABITAT FOR HUMANITY by the 93 year old Jimmy Carter, the 39th President of USA, cancer survivor, and his 91 year old wife as a 'Personal Social Responsibility' in one of the basic needs of Human beings.

*The 'Super-30' institution of Anand Kumar, of Patna, India, where, since 2002, he coaches 30 poor children every year in his free residential school, 500 of whom, so far, have succeeded in one of the toughest entrance tests in the World- to get admitted to one of the Indian Institutes of Technology. Admired all over the world, multiplying such an Institution requires his kind of steadfast COMPASSION and PASSION, not mere Money, or 'Bricks and Mortar'

*The recently announced DECISION of 54 year old JACK MA, the self-made billionaire of China to leave Management of ALIBABA he created in Garage, to TEACH ENGLISH, his passion!

There must be several such inspired and inspiring individuals and Organizations who quietly yet immensely contribute, to make the World Happier, through GOOD WORK by involving 3H.Personal Happiness is their well- deserved 'reward'.

Any Work including such self-motivated efforts, will be better- more efficient and effective – by well thought out WORK SYSTEM DESIGN(WSD)- the core theme of this paper.

The prevalent widespread disconnect between LIFE, WORK, and HAPPINESS must be bridged by WORK SYSTEM DESIGN To CREATE and SUSTAIN GOOD and SMART WORK in all spheres : Economic, Social, Intellectual, Sports, Performing Arts, and indeed in each activity performed by every human being, through the PERPETUAL PURSUIT OF **PERFECTION (3P)** or equivalently, through PERPETUAL PURSUIT of **TRUTH or'** ONENESS' of THOUGHT, SPEECH, and ACTION.

SOME OBSERVATIONS ON WORK- RELATED CONCEPTS

Some more observations on WORK and few closely related concepts here will be helpful:

*ANY WORK has three interconnected aspects-Physical, Intellectual, and Emotional, -involvement of which, all the time, ensures the Best possible Work .

*Work and Knowledge are inter-dependent. Each re-enforces the other.

*'Enjoy what you DO and DO what you enjoy' is a good axiom.

*Getting involved and 'living in the moment' while working ensures best possible Happiness and results.

*Make a LIFE, not merely a 'living' through Work

**"Yoga Karmashu Kaushalam" (Verse 50/ chapter Two of The Bhagavad GITA) captures the essential HOW and WHY of any WORK*

*LOVE for the Work and for the beneficiaries, is the ultimate MOTIVATOR of WORK; not Financial incentives nor other rewards, awards and recognitions and not certainly, Fear.

With global-spanning Technologies like internet, WWW, social Media in Post I.3 and I.4 era, Work places and Teams are now Globally dispersed as are the Value Chains-horizontal and vertical, now, digitalized. With BIT COINS and Block chains, the traditional 'brick and mortar' Banking operations will be digitalized in cloud computing. Individualism, Flexi-Time and places of work, instant collaborations and instant Team building and dispersal, call for newer approaches to DESIGN of WORK and WORK SYSTEMS.

Like in any DESIGN, CREATIVITY is at the core of Work System Design.

2. CREATIVITY:

*Originates from 'out of Box' thinking, dreams, vision, and inner freedom to explore.

*Requires 'Non-confirm 'ism, imagination and ability to ask innocent, child- like, ego-less questions.

*Cross-pollination, openness, patience and passionate pursuit.

All Inventions, and Innovations are visible manifestations of Creativity in action.

3. HUMAN BEINGS CREATE EVERYTHING

All Sciences, Technologies and Knowledge are intellectually conceived by Human Brains and physically created by Human Brawn with help of brain-created knowledge of Scientific insights and brain-conceived Technologies from pre-Industrial periods to date as we enter the unfolding Space Technology era, to explore the unfathomable, vast Universe or Multi -verse.

Human BRAIN, a mere 3 pounds of NEURONS in 10,000 classes, each capable of forming 10,000 Synapses (connections) totaling to staggering 1000 Trillion synapses. Humans also have 86 billion NERVE Cells in 1000s of varieties. We cannot complain about huge generosity of our Creator in bestowing on us, tremendous INTELLIGENCE to THINK, CREATE, INVENT, and INNOVATE- individually and in TEAMS. It is up to us to create a more beautiful, happier World, each passing day using these ever-growing, never-ending endowments

From birth to death, the brain-regulated growth and gradual decay of Human body and mind, spread over decades is wonderful to conceive! It is true for ALL LIVING BEINGS.

The generic 'Intelligence' has been classified into many aspects like: Logical-mathematical, spatial, Existential, inter –personal, Intra-personal, (KNOW THYSELF!), Natural, Kinesthetic, and Musical. More, finer nuances can be added.

Each work in any context requires intelligence.

Several aspects of intelligence lead to conception, Creation, and utilization of Sciences and Technologies- in myriads of forms – which shape human life and work, from cradle to grave.

4. SCIENCE AND TECHNOLOGY (S & T)

SCIENCE AND TECHNOLOGY ARE INSEPARABLE. Each reinforces and helps the other to diversify and grow and are borderless.

More SCIENTIFIC understanding spawn newer Technologies. Without aid of Technologies, Scientific research, inventions, explorations will not be possible. The TWIN form a SPIRAL- benign or malign, for construction or for destruction, for building Space-ships or making Hydrogen Bombs – for Peace or War –as desired by the on Human DECISION MAKERS!

Human BRAIN (HEAD) conceives and BRAWN (The Working Limbs, symbolically,-'HANDS)' together, keep creating Sciences and technologies, and use them to make and distribute never –ending trillions of artefacts to meet human need or greed. Their uses, abuses, or misuses depend on Human judgement and emotions (HEART).

Speaking allegorically, as the common saying goes, sometimes, the distance between 'Head and Heart' is the longest!

This may explain fast proliferating Science and Technology–in specialization, and sophistication-coexisting with extreme poverty, homelessness, diseases, in the World.

Later in the sections on–Business Management, Country Governance, and United Nations organization, Globalization, we will examine the genesis of / solutions for this paradox .

5. THE GRAND 'TREE' OF KNOWLEDGE

SCIENCES-Mathematical, Astronomical, Geological, Biological, Physical, Chemical, Material, to name a few, along with their ever – proliferating specialized and super-specialized branches and sub-branches, by exploration, observation, experimentation and logical conceptualization explain WHAT, WHY, HOW of parts/sectors of Universe in their domains, often knowing 'more and more'about 'less and less' of their ever-shrinking and ever-deepening 'silos' of domains. (Ultimately, Knowing Everything about 'NOTHING'- stated in a humorous vein!), Yet, seriously, defining and researching about Science and Technology of ABSOLUTE NOTHINGNESS could be the next interesting and important challenge!)

Luckily, in between the panoramic GRAND TREE OF KNOWLEDGE and the deepest points in SILOS, there are 'Specialists in Generalization' at various critical branches and

sub-branches, who try to maintain 'holistic perspective'. The INDUSTRIAL ENGINEER is one such SPECIALIST IN GENERALIZATON who marshals relevant branches of the TREE OF KNOWLEDGE and cooperates with many other specialists to DESIGN and maintain BETTER WORK SYSTEMS.

Too broad and fast expanding as Sciences are, besides the foundation- laying pioneers like Galileo, Newton, Darwin, Einstein, and Stephen Hawking and their too well known contribution, only few more randomly selected recent advances are being mentioned below:

*Existence of Multi-Verse with 2 Trillion Galaxies, each with Billions of STARS : In this inconceivable unimaginable vastness, our 'Earthian' Neil Armstrong has taken a few 'baby'steps on our backyard, the Moon! We have light-years of distances to go in Space-Exploration !!

*In addition to 4 known Forces – Gravitation, Electro-Magnetism, Strong Nuclear Force, and weak nuclear force, the 5th, Radio- active decay has been recognized.

*New Particles: Quasart, 'theoretical' Oderon, Hadron, Photon (quanta of Light) have been found/imagined.

*Light is being used to create miniature TOOL like optical tweezers to manipulate microscopic objects and even living organisms. High density ultra- short Optical pulses are being generated as parts of research in Laser Physics which earned this year's Nobel prize in Physics for 3 researchers.

*Genetic evidence is already in use in solving crime.

*Researches by three, 2018 Nobel Prize winners in Chemistry promote a 'greener' Chemical Industry: produce new material, manufacture sustainable Bio-Fuels, mitigate diseases, and develop Proteins by genetic change & selection that solve chemical problems.

*Earth receives Radio signals from Space, may be, from more intelligent inhabitants from another Galaxy! We will love to meet, greet, and learn from our far away smarter Cousins, some day, somewhere!.

Science-backed Technology, from pre-industrial period through Mechanization (Industry1.0), Mass Production /Electricity (Industry 2.0), Computer, Automation, Electronics (Industry3.0), is now in (Industry 4.0) era of AI, Machine Learning, Deep Learning, Robotics, Cloud Computing, Cognitive Computing, Drones, Quantum Computing, Personal Quantum Computers, Nano Technology, VR/AR, Visible Light Communication, Tensor processing unit chips, Encryption chips, Neural Networks, and social Networks like Face Book, google, and Linked-In. Almost each day a new technology appears, like, Pocket Selfi Drone, Selfi quadcopter.

Among the numerous spectacular/ beneficial Applications of Industry 4.0 Technologies, to quote very few, are:

* Facial recognition- we can walk through the Airline check-in counters with a smile!

*language translation – A boost to Tourism and cultural exchanges. Many languages are vanishing fast along with the culture they carry. It will help salvage their essence.

*Drones are used in Agriculture.

*Humanoid robots now run and leap. (Be aware of one nearby!).

*Capability to see through walls using wireless signals

Misuses and Dangers:

Possible misuses of Technology include anti-social criminals like terrorists using the same to destroy life and property, loot Banks, hacking hardware and software to spread misinformation and interfere with political and socio-economic processes anywhere.

Cyber security is a major issue.

*There is also an apprehension that deep space travel, to Mars may cause Gut-Cancer.

S&T have More challenging and useful Problems TO SOLVE:

Hopefully, S&T, in near future, will make it possible to:

*Derive Water from Desert Air, have wireless Electricity, Desalinate Sea Water, and make computer see things.

* predict weather, and related important events like Earth Quake or Tsunami, sufficiently in advance, to escape death, and destruction of property.

*IT- enabled Management of Education, Health, Social development, Industrial Organization, and Management, Infrastructure Planning, Construction, and Maintenance.

In a GRAND CLIMAX, the MANKIND on Earth is waiting for The Entire Tree of Knowledge including S & T, someday, to EXPLAIN HOW and WHY the UNIVERSE including ALL LIVING BEINGS AND THINGS , WORK!

In this incessant advance of Science - based Technology and Technology-enabled Science, can S&T, reverse - engineer human Brain which is self – organizing and adaptive, inquisitive, unbounded, and can recognize problems to solve. ?

6. THE BRAIN AND THE ARTIFICIAL INTELLIGENCE (AI)

AI and related developments like Cloud computing through Data Mining, and sharing are already in extensive good use , for example, in Legal intelligence, make technology adapt to human needs like thermostat setting the temperature or phones controlling grammar, or having vision. More such spectacular uses are on the way with Low power encryption CHIPS, Personal Quantum Computers, Tiny Drone Helicopters, and Tensor Processing Unit taking 'QUE' from Brain.

ROBOTICS are great to replace Human brawn- power, leaving Human Beings to Think and to be Empathetic.

Will there be, someday, a THINKER CHIP, to mimic Brain?

All the interesting and helpful - information, advice, orentertainment we get from SIRI, ALEXA, ANDROID, CORTANA and the likeare based on limited data, not on the spot ,active "thinking'.

There are dangers from misuses too. Data - based AI can be biased, unethical, and misleading. Social Media is fighting Data theft in huge numbers besides misuses in influencing political Process. From Terrorists to career criminals, chilling possibility of information theft and misuse is happening. Cyber security is a concern, with millions of personal information being hacked from membership base of huge social networks.

Intellectual Property theft is easier.

Harvested and mined statistical Data behind AI may be biased and even faked.

Finally, be aware of 'Killer' ROBOs around!

HUMAN BRAIN(S) BEING THE CREATOR of AI, AND ALL TECHNOLOGIES, ARE, SHOULD BE AND WILL REMAIN INCHARGE OF CREATION AND USE OF ALL SCIENCE AND TECHNOLOGY (S & T).

To sum up, the BRAIN is endowed with Higher INTELLIGENCE, has creativity and EMPATHY which AI or other S&T products can never have.

It will be in order here to repeat the following two quotes of very well-known persons from World of Learning and Action:

Late Stephen Hawking, the famed Astro-Scientist of this era, thought: 'AI is the WORST event in human Civilization'. Very strong yet thought provoking warning!

Bill Gates, the living legend:'Scary that Technology can empower small groups to do great harm,'

However, like we cannot throw 'the Baby with Bath-water';we should not give up the AI and other wonderful Technologies, recent or old, and indeed any S&T insights and products, existing and fast - expanding- but be aware of the lurking dangers in their abuses and misuses and apply our over-riding ,Intelligence to use their huge proven potential for GOOD WORK through better WORK SYSTEM DESIGNS.

The lingering paradox is the inability of all S&T- propelled Developments in all fields of Human life and living from space travel to fine Arts, with myriads of institutions, products, services, Games, Sports, music, Dance, Drama, from Day 1 till date, to 'wipe out every tear from every eye' and lack of enduring TOTAL HAPPINESS ,almost in each human Being. We will discuss possible 'why and how' of this paradox in following three Sections.

7. BUSINESS MANAGEMENT

Myriads of Goods and Services we use for basic necessities like Food, clothing, Housing or better living- from 'Bread & Butter' to automobiles/air travel, to Tickets for Games or Movies to reserve seats for future Space travel, are made and marketed by 'for profit' Organized BUSINESS-Private/ unincorporated or Public/incorporated'. Even 'not for profit' charities have hierarchical' professional' management like the for- profit ones.

Some of them like Ford, General Motors, the Auto Giants, or Microsoft, Apple and Face book, to name just a few, have significantly changed the way we live and have contributed significantly to the Happiness of myriads of people. Some of these giant pioneers and many other Corporations - big and small, have acted in socially responsible manner balancing interests of all stakeholders, not just their stock holders.

Businesses of Infrastructure Building and Maintenance – for Power, transportations and Communication, provide lifelines for modern living.

Quality Healthcare and Education are provided by some of the 'for-profit'corporate style institutions in these areas.

ALL from Super –rich to the middle class to those in extreme poverty enjoy these bounties, often for- survival necessities, to the extent of their purchasing power.

For example, everyone from young children to the Homeless craves for and many have 'I- phones' with a screen-full of 'APP's.

BLOCKCHAIN Technology is restructuring contracts, transactions and record keeping with impact on wide fronts of activities: Business Management, Country Governance, and international Transactions through WTO and inoperational aspects of the UNO.

Yet, all is not well with Management of some Businesses.

*Over –riding and unlimited Profitability- chasing with eyes on share prices in Stock Market and/or lax, incompetent supervision, have sometimes harbored fraud like deliberately misreporting quality checks/ inspection information by even some well respected, corporations..

*Exorbitant margin of profit, even in life- saving medicines, with or without interventions by Regulatory Authorities, is inexcusable. The “HEART” is simply missing from the 3H!

*Low wages forces homeless workers ofeven some rich and famous corporations, to sleep in their cars or on streets. At lower end, there are sweat-shops and child labor, working long hours in unhealthy work places for less than survival hourly wages.

*Business Management, in the Globalized supply and delivery chains, facilitated by easy B to B communications, often accentuates bad working conditions, exploitation, and poverty in poorer countries in the chain.

*Almost everywhere, and at every level, there is **lack of synergy between Doing and Thinking. Supervisors /Managers 'think and instruct 'Doers' on what** and how to DO. This old practice is outdated with spread of education when every Worker can THINK, perhaps better, being involved with their work.

In the internet Era, now, Work place is Global & 24/7 beyond direct supervision. .

The creation and infusion of 'professional Managers' with specialized broad based degree programs covering Production, Marketing, Finance, and Human Resources Management from Universities, has been helpful in this direction, if and when enlightened Top Management, primarily representing major financial shareholders , have not directly or indirectly, pressured them to chase short term profitability relentlessly to the exclusion of other stake holders.

Moreover, the professional Managers, not having practical experience of the Work, they manage, often constitute another upper level SILO super-imposed on the specialized silos of workers, Technicians, and even Engineers, or the similar professionals like Physicians and para-medics. They cannot integrate and comprehend the rich details of world of action they seek to manage.

Cooperative collegial attitude instead of traditional 'command and control' style, is more likely to create and sustain an efficient, effective, and HAPPY Organization.

8. COUNTRY GOVERNANCE

The 200 plus Nation States in the World widely vary in size and population from tiny Bhutan or Vatican City to huge USA, China and continent- spanning Australia. Each, however zealously holdits 'sovereignty' dear, to safeguard which, maintains a Military Force spending their own or borrowed financial and material resources, often , , depriving other socio-economic sectors, more vital for their citizens.

System of Governance, in practice, vary from Constitutional Democracies with periodic Elections to Dictatorships and many varieties in this linear Scale. Distinct separation of role and responsibilities between legislative, Executive, and Judiciary Functions, constitutionally guaranteed basic Rights of citizens and a FREE press are the Hall marks of Democracies. Dictators on the other extreme depend on military might and on super privileged and rich oligarchy, kill or put in jail those opposing them in sham elections with no orplanted fake'opponents '.

Corruption, bribery, and deprivation of citizens, in mounting number and severity, decreases real ground level Development for all, except few showcase Cities common in the countries at the Dictatorship End of Governance .

Sometimes, even Ex- Presidents and Prime ministers flee,or go to Jail, if not killed by irate citizens.

Modern World-binding Technologies of internet, AI, social Media, and the like, have the potentiality to make the governing process more efficient and effective.

However, their misuses, can do great harm also.

Ethnic, Religious conflicts, and Terrorism make settlers nomads again. Muteanimals like Elephants, Rhinos, and Lions, not to talk of smaller species are vanishing, for pleasure or profit with no effective, real preventive actions by Governments .

Even in the field of Games and Sports, including the Olympics, rules on substance abuse are violated, sometimes with obvert and subvert connivance of country Governance .

No wonder, there is so much poverty co- existing with the few super- rich, at the top of the pyramid, in most countries.

As someone put ironically: 'In the Annual meeting of well-meaning intellectuals and Socio-Economic Development Specialists, at Davos, the Billionaires talk to Millionaires about eradication of, at least extreme poverty'-estimated at 47% of world population

The logical approach is still through Democratically elected Constitutional Governance- of the People, for the People, by the People, with fullest participation of citizens, which will keep focused on developing the LAST PERSON ('Gandhian version :*'Antodaya* '), and try to 'wipe every tear from every eye' and thus bring HAPPINESS FOR ALL.

Right approach to eventually achieve this UTOPIA –sounding but achievable objective, is Country Governance concentrating on Health, Education, Infrastructure Development and Maintenance, on all fronts like Housing, Transportation, Power, Communication for common use by all. This will provide productive engagement opportunity to all willing to work and supplement efforts of Business and Industries on creation of adequately paying jobs.

'Holistic' Education - intellectual, physical, social, and emotional- for fullest possible development of body, mind, and Soul of each citizen at affordable cost or for free, to all who desire and deserve, should be the topmost priority. Learning can be in class rooms, from Nature, and from social interaction with 'things and Beings', and from Open, often free class rooms on internet enabled –Global campuses.

Most importantly, Education from 'Doing' reinforces and refines both. It is lifelong and enjoyable. Use of modern S & T is making Education continuous and almost, free.

Availability of affordable lifelong HEALTH CARE - physical and mental- for ALL is the other primary task of Country Governance with emphasis on Prevention-through cleanliness, physical work/ workouts, healthy Food, and style of living. . Curative treatment – diagnostics, medicine, and surgical, when needed, must affordable byand within reach of all.

If there is a will, there are ways.

An exceptional model in Country Governance is the case of tiny BHUTAN, where the enlightened hereditary KING, by decree, has introduced 'one-person one-vote' modern democracy over its already Happy citizens, thanks to the benign Ruler, now 'reluctant democrats', participating in elections.

BHUTAN King has introduced GROSS NATIONAL HAPPINESS (GNH) as measure of its success. How about all trying it out rather than sticking to GNP, GDPor other financial profit related traditional ones?

There is no end to tasks, nor lack of S&T aids or ideas for efficient and effective Good Governance of Countries– small or big.

9. THE UNITED NATIONS ORGANIZATION

The United Nations Organization, through its many agencies like UNESCO, ILO, WHO, WB, IMF offers expertize and help to all countries to improve their Economic, Social, cultural, and Humanitarian conditions while maintaining peace in the World without wars, and terrorism.

However, much of the bilateral, international financial and non-financial Aids- for disaster relief or for development, often do not reach the real needy due to corruption and inefficiency in receiving Countries in the long channels between Governments and the real needy, specially, in rural areas.

In any case, due credit must go to the UNO for having at least prevented a World War III, since it came into being after massive death and destruction in World War II.But, in spite of its primary Goal of Nuclear non-proliferation, and hopefully, Nuclear disarmament, 6 countries, in last count, have a stock pile of 14,923 Atom bombs, not knowing how many others, including terrorists, have real or 'dirty Bombs'. World has witnessed devastation caused by just TWO Atom bombs, with its adverse effects continuing till now.

Destructive Wars are also massive S&T based 'efficient and effective', WORK SYSTEMS gobbling up best of Human and Physical resources depriving many of basic needs for survival.

UN can help Governance of Countries, specially lacking in physical, financial resources or expertise to develop their Health, Education, Infrastructure development and upkeep, in Power, Transportation, Communication etc. through its appropriate agencies and thus facilitate their interactions and integration with Global communities .

Supply chains for all activities - physical and digital - now encircle entire World. Information is instantly available to all to care and share.

10. CHARITIES

Charitable persons and Organizations- Individual 'Do-Gooders' to big ones like Red cross, Doctors without Borders, Bill Gates, Warren Buffet and numerous others , keep playing a vital role , supplementing Governmental effort almost in every socio-economic area, all the time.

Each of the millions of activities at Corporation, Country, UNO or Charitable levels, are done through Trillions of WORK SYSTEMS, which can be DESIGNED and RE-DESIGNED to ensure EFFICIENT and EFFECTIVE WORK in their areas of operations.

For example, imagine the tiny wrist watches packed with APPS Or the Airplanes or the giant earth moving Machines or space rockets. Each of the components - tiny or big, have been designed and made and later assembled at Worker-Equipment operation/processing centers.

Or imagine delivery of Health and Education or distribution of survival essentials to people who lost everything in Natural disasters- flood/fire where time is critical .

Efficient and Effective Work Systems are to be Designed /re-designed for each of them. The time-tested principles and approaches of the Industrial Engineering can help as explained in the following section.

11. DOMAIN AND MANDATE OF INDUSTRIAL ENGINEERING

Birth of Industrial engineering:

Among few examples of vertical rise from Worker level to be an Engineer and then onto become Manager, was F.W. Taylor, the 'Father' of Scientific Management. He along with Frank Gilbreth, Elton Mayo, A. Maslow, A. Herzberg created basic principles, techniques, and approaches of modern INDUSTRIAL ENGINEERING.

The Professional domain/mandate of INDUSTRIAL ENGINEERING is the DESIGN of WORK SYSTEMS with involvement of Hands, Head, and Heart (3H) to ensure the Perpetual Pursuit of Happiness (PPH) for all involved , as part of endless yet thrilling journey of Perpetual Pursuit of Perfection (3P).

EACH AND EVERY WORK, with or without 'TECHNOLOGY'-pre –industrial 'stick and Stone' period to post Industry-4.0 SPACE era Technologies, -require Imagination, Creativity, Invention, and Innovation.

With increasing complexity of Work Systems due to fast - advancing knowledge of S & T, Industrial engineering Professional, not as ' lone wolf' but as an indispensable critical member of Work System Design TEAM, brings unique ' holistic' and '3H' perspective, to the DESIGN and Installation process, in each and every work situation.

We may begin by quoting the formal definition: “Industrial Engineering is concerned with the DESIGN, improvement, and Installation of integrated SYSTEMS of men, materials, and Equipment. It draws upon specialized knowledge and skill in the Mathematical, Physical and Social sciences together with the principles and methods of Engineering analysis and design to specify, predict, and evaluate the results to be obtained from such “SYSTEMS.” quoted in our IIIE JOURNALS.

Notice that, it describes the PROCESS, not PURPOSE of WORK in a value-neutral way which can be Constructive like manufacturing surgical instruments to SAVE life or making destructiveknives to kill, apparently leaving the discretion, to the JUDGEMENT and CONSCIENCE AND FEELINGS (matters of HEAD and HEART) of the USER.

Briefly, IE is concerned with WORK SYSTEM DESIGN to ensure Efficient and Effective WORK.

SYSTEM can be conceived as 'INPUT---- PROCESS---- OUTPUT'.

Efficient Work systems require LEAST INPUT RESURCES of Material, Energy, Time and Information. Energy and Time of both Workers and Machines are to be minimized. Fatigue of Human beings has tobe minimal and compensated through periodic rest pauses. Relevant information - gathering and distributing, being expensive, must also be minimized.

The PROCESS - one or more Worker (s) and/or Machine(s) WORK Centers,- must convert LEAST OF ALL RELEVANT INPUTS to produce MAXIMUM DESIRED **OUTPUT of ACCEPTABLE QUALITY** with least wastage /rejections.

Workplaces must be clean, congenial, healthy with least noise and clutter. Lighting, Color and Music are also being tried to enliven its ambience.

To re-emphasize, total involvement of 3-H of each human participant in the Process can only ensure best possible PRODUCTIVITY of REAL RESOURCES.

Unlike the Cost Accounting convention of treating Machines and Money as the CAPITAL RESOURCES, HUMAN RESOURCES are and must be treated as CAPITAL RESOURCES, as they work for longer years than replaceable machines. The Human components create, modify, maintain, and replace Machines.

Treated with dignity, and respect, besides fair and adequate compensation, minimally ensuring decent living for self and family, Human beings in Work systems, can alsobe goodwill Ambassadors and public –relation persons of the Organization for present and potential buyers/ consumers of its products/services. It is tragic that so many Workers are homeless; so many children go to bed hungry; and pick trash rather than go to school and die untimely in this age of High-Tech wonders.

It will be appropriate to quote, Robert Owen [1], owner of New Lanark Mills, Edinburgh, who way back in 1813 wrote: “Time and Capital must be more advantageously applied to improve living Machines”.

The Tool-kit of IE-: Traditional and Modern:

From WORK STUDY- Time and Motion study days of F.W. TAYLOR [2] and F.B. GILBRETH [3], way back inearly 20th century, WORK PLACE LAYOUT to optimally place tools for convenient reach and sequential use by the operator, at any WORK PLACE –Factories or homes- are ever relevant.

Tried, tested and perfected simple 'Principles of MOTION ECONOMY' are ever- green productivity-enhancers in any work situation. Micro-motion studies and THERBLIGS of Gilbreth have further refined it.

Ergonomics/Human Engineering studies, in the aftermath of WW-I, for Redesigning Machines to suit physical and mental limitations of Human Beings have added challenges and opportunities for better Work System Design followed, for example, in designing Cockpits of AIR CRAFTS to facilitate flaw-less interaction between Pilots and complex array of Dials and Controls.

Industrial Psychology and Sociology came to focus through researches by Lilian Gilbreth, [4], and GE Mayo [5][6].

Motivation of Workers keeps bothering all- in Business, Industries, Schools, Hospitals, and Government Bureaucracies, everywhere. AH Maslow's [7] Need Hierarchy, and F. Herzberg's [8] Two- Factor Theory provide theoretical framework, yet to be thoroughly tested in practice. his humble author[9] strongly feels that LOVE –for WORK and for the ultimate beneficiaries of Work are lasting motivators.

The bulging Tool-bag of IE has been embellished by post WW-II OPERATIONS RESEARCH- Mathematical and Statistical models as aids to OPTIMAL DECISION making, to Maximize/ minimize monetary profit/lossor any other quantifiable objective, subject to a set of constraints, Queueing theory, Simulation, Game theory etc, excellently explained by Churhman et.al [10] and many other knowledgeable experts. Human related parameters, like minimizing fatigue/boredom or maximizing Satisfaction are not in the formulation as objectives or constraints, waiting to be 'quantified'. Another landmark was J.W, Forrester [11], 's Industrial Dynamics modelling used by the IE in appropriate situations.

In the current Industry 4.0 cyber –physical era , AI, internet, Big Data Analytic, Cloud computing, Robotics, IOT, IOP, extensively used vast Social networks, Nano –technology, Instant communications through miniaturized I-phones, there is no dearth of Technology for WORK SYSTEM DESIGN by imaginative, creative, Industrial Engineers and Management Scientists.

Quality, Safety, Maintenance are also important aspects of WSD

IE professionals should continue to maintain the HOLISTIC perspective in Work System Design through these overwhelming avalanche of hard and soft S&T insights, tools and techniques, keeping firm focus on involvement of Hands, HEADS and HEARTS , to make the World HAPPIER.

12. PERPETUAL PURSUIT OF HAPPINESS

*Religions, Philosophers, and older citizens have given simple ideas and prescriptions for Happiness: Reduce desires and wants; Give more and take less; Share and care; Prayers;' Do onto others as you would like others to do onto you'; Work as a duty without expectation of return; Help the needy, Nurse the sick and the disabled; Respect elderly and Love children.

*Other simpler ideas for happiness include: Counting Blessings, showing simple acts of kindness, practicing forgive and forget, Thanking a Mentor, Gratefulness to benefactors, Investing time and energy for Family and Friends, and Having tolerance and patience, (…. this too will pass!)

*Once basic needs are met, Doing what you love and Loving what you do. Many, though not all enjoy their profession, like performing Artists or Sports Persons or Professionals like Doctors or Teachers.

*Savoring sensory experiences.

*Finding ways to make your life more meaningful for you and others.

* Sacrificing for the Cause you hold dear- Many sacrifice their lives for independence of their country

* Follow examples of Exceptional individuals who WORK for LOVE to help SOCIAL cause.

* March 15,each year is celebrated as International Day of HAPPINESS- to remind us of our right to have it and

responsibilities to WORK for Happiness of ALL.

*Only tinyBhutan, among 200 + countries of the World, measures and pursues Gross National Happiness (GNH) as measure of 'goodness' its Governance.

This can be formally adopted by other countries, through UNO Agencies or by private World Economic Forum at Davos, to test its efficacy relative to prevailing measures like GDP/GNP, quantitatively, and find the correlation, if any, between average Economic Wellbeing and Happiness and to reconcile the measures eventually by a compound ,comprehensive measure.

Of course, any Average measures hide the lower end of Extreme Poverty for whom, without fulfilment of minimal BASIC NEEDS of Food, Clothing, Housing, Literacy, and Health, talk of Happiness is, more often , a cruel joke!

There are nolack of opportunity to WORK for and with Love.

The core content of Industrial Engineering philosophy: involving HAND, HEAD, and HEART in anything you DO and being in PERPETUAL PURSUIT OF PERFECTION will ensure true and lasting Happiness, in any context.

Pursuit of HAPPINESS, moment by moment, is an enjoyable and endless journey.

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