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INTELLIGENT SYSTEMS TECHNOLOGIES: INTELLIGENT SYSTEMS TECHNOLOGIES THE CORE FOR INFORMATION SOCIETY

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1.0 INTRODUCTION

The birth of intelligent systems Technologies the real change of the society in creation, distribution, and manipulation of information to have high productivity in our organizations, companies, firms or businesses, and security organs, this activated the innovative power. Intelligent systems are the computer embedded or controlled systems, machines and devices that create, distribute, and manipulate, and possess information in a certain degree of intelligence, capacity to communicate with other systems. The intelligent systems have capacity to learn from experience, security, connectivity, the ability to adapt according to current data and the capacity for remote monitoring and management or technologically advanced machines and devices that perceive and respond/ interact to that environment around them. Intelligent system include interconnected collections of intelligent devices, including networks, and sophisticated Artificial Intelligent-based software systems (Oliveira, 2017).

In intelligent systems Technologies covers the systems and the design of smart tools using foundational theories, methods, and technologies involved, the tools, processes, and methods needed to design, implement, and test complete systems, network optimization problems and optimization techniques, efficient algorithms, algorithms processing strings and texts, Signal processing techniques, Computational approaches, network analysis, Graphics & Vision technologies (methods and techniques involved in large-scale software development) and distributed system (core techniques, algorithms, and design philosophies(Rodriguez, Mitra, Thampi & El-Alfy, 2016). All these constitute the construction/building of the intelligent systems Technologies a round us like; Fuzzy systems, Neural Networks, and Expert systems, control and electric power systems, database and learning systems, signal, Image, and speech processing systems, Manufacturing, industrial, and management systems all use computer hardware, operating systems, automated intelligent software, internet connectivity, security tools and electric power (Berretti, Thampi, & Srivastava, 2015).

Information society envelopes; script to print, mass media and new technology, information market-place, access to information, political dimension, information rich and information poor, freedom of information, protection of intellectual property, data protection and personal privacy, censorship, information professional, work of the information professional, archetypes in transitional, from archivist to records manager, information managers and managing knowledge (Feather, 2013). All society activities being transferred into information and converted into digital work, this means driven by intelligent systems technologies. New society which intelligent system is helping to create, the revolution which it has both inspired and driven. Information dependent society at is emerging from our revolution the post-industrial revolution combine both profound change and fundamental continuity tools of communication are the building blocks of information society. The convergence of technologies allows us to combine computing with telecommunications and digitization of text and image to permit almost instantaneous worldwide (and indeed extra-terrestrial) transmission of data (Feather, 2013). Now this has been speeded up by intelligent systems technologies in an advanced way. Europe, china, Singapore, and USA, Netherlands, Taiwan, Japan, Canada, Sri Lanka, South Korea are post –industrial (information society has turn information a valuable mineral above other minerals in the world) America leads the informationization and Western Europe and East Asian tigers in, and an engine to development.

1.1 Review of the Theories on intelligent systems technologies

1.1.1 Basically a search technique

Works on the theory of evolution proposed by Darwin. According to his theory the fittest species survived the evolution process and the weak perished. Talking in terms of feature selection, the strongest feature survives all the iterations (mutation phase) and others are eliminated. The parameters used in this algorithm resemble the theory of evolution, like mutation, population size, number of generations, chromosome, etc. Fuzzy set theory, the theory of fuzzy sets was first founded by Lotfi Zadeh, primarily in the context of his interest in the analysis of complex systems. The concept of the fuzzy set is a generalization of the classical or crisp set. The crisp set is defined in such a way as to dichotomize the individuals in some given universe of discourse into two groups: Members (those that certainly belong in the set) and non – members (those that certainly do not). A sharp, unambiguous distinction exists between the members and non- members of the class or categories do not display this characteristic, their boundaries seen vague, and the transition from member to non-member appears gradual rather than abrupt. Thus, Fuzzy set introduces vagueness by eliminating the sharp boundary dividing members of the class from the non- members (Rodriguez, Mitra, & Thampi, 2016).

Fuzzy sets F in a universe of discourse U is characterized by a membership function μF which takes values in the interval [0,1], namely, μF: U → [0,1]. F in U can be represented as a set of ordered pairs of a generic element μ and its grade of membership function: F= {(u, μF (u)u | u ∈ U)}. When U is continuous, a fuzzy set F can be written as: $F = \int_{i} \frac{\mu F\ (u_i)}{u_i}$.

When U is discrete, a fuzzy set F is represented as: $F = \sum_{i=1}^{i=n} \frac{\mu F\ (u_i)}{u_i}$,

Each membership function represents a linguistic variable (regarded either as a variable whose value is fuzzy number or as a variable whose values are defined in linguistic terms). Linguistic variable is characterized by a quintuple (x, T (x), U, G,M) where x is the name of the variable, T(x) is the term set of x, U is universe of discourse, G is a syntactic rule for generating the names of values x, and M is the meaning of the sematic rule(Rodriguez, Mitra, & Thampi, 2016).

According to Rodriguez, Mitra and Thampi (2016) Fuzzy logic is logic based on fuzzy set theory. Fuzzy implication inference for approximate reasoning. The rule is of the form: IF (a set of conditions) THEN (a set of consequences).

It is basically a search technique which works on the theory of evolution proposed by Darwin. According to his theory the fittest species survived the evolution process and the weak perished. Talking in terms of feature selection, the strongest feature survives all the iterations (mutation phase) and others are eliminated. The parameters used in this algorithm resemble the theory of evolution, like mutation, population size, number of generations, chromosome (Berretti, Thampi & Srivastava, 2015). This theory is used to build logic systems due that the system use logic decision, processing, and problem – solving search methods.

1.1.2 Bayesian Decision Theory

A fundamental statistical approach to the problem of pattern classification. Quantifies the tradeoffs between various classifications using probability and the costs that accompany such classifications. Assumptions: Decision problem is posed in probabilistic terms. Bayesian decision theory refers to a decision theory which is informed by Bayesian probability. It is a statistical system that tries to quantify the tradeoff between various decisions, making use of probabilities and costs. An agent operating under such a decision theory uses the concepts of Bayesian statistics. Bayesian Theorem; is a theorem of probability theory, used in a wide variety of contexts, ranging from marine biology to the development of Bayesian spam blockers for email systems. Confirmation, falsification, the relation between science and pseudoscience are precise and extended or correct by using Bayesian theorem. The theorem works on the basis that calculates the probability of a new event on the basis of earlier probability estimates derived from empirical data (Jin, Lin, 2011).

The Bayesian theorem compresses of the following; Bayesian classifier is optimal, it minimizes the classification error probability, use discrimination function-leads to suboptimal solution, decision boundaries in the higher dimensions (decision surfaces-use a quadratic form, linear classifier is used in the discriminant function and using identical variance). Also Bayesian theorem minimum distance classifier used the two likelihoods have identical covariance and two classes are equiprobable, the discrimination function simplifies. Univariate normal distribution uses the discrete sum to 1. Parameter estimation involve maximum likelihood parameter estimation, uses the properties of the maximum likelihood estimator - includes asymptotically unbiased, asymptotically consistent (Elder, 2015).

1.1.3 ASP (Answer Set Prolog)

Reasoning by cases includes two choices – follow the rules. Knowledge representation, reasoning, and design of intelligent agents use answer-set programming approach, use logic-based approach to agent design, translation from natural language, answer set prolog (First-order logic ‘FOL’), Nonmonotonic logics, default and Negation.

1.1.4 Knowledge representation and reasoning

In the Knowledge representation and reasoning, context helps to refine the queries made by users, used as a flexible formal tool for the design of systems of autonomous agents. Human-machine interaction, context is used to design context-sensitive applications and interfaces. LSpairs was later represented as contexts as a finite representation of a logical theory. The context theory was divided into two; divide – and – conquer theory a way of partitioning a global model of the world into smaller and simpler pieces, compose – and – conquer theory; considered context as a local theory of the world in a network of relations with other local theories. The theories use knowledge in a reasoning process to infer new knowledge from that already available. Divide-and-conquer, there is something like a global theory of the world. This global theory has an internal structure, and this structure is articulated into a collection of contexts (Bouquet, Ghidini, Giunchiglia & Blanzieri,2003).

Compose-and-conquer theories start from the assumptions that local (domain specific, goal directed) theories of the world are the building blocks of what an agent knows, and that the totality of the agent's knowledge is given by composing such local theories through a collection of rules that connect them into a more comprehensive (but still partial) representation of the world (Bouquet, Ghidini, Giunchiglia & Blanzieri,2003).

Agent architecture consists of four components:

- ***Units:*** Structural entities representing the main components of the architecture.
- ***Logics:*** Declarative languages, each with a set of axioms and a number of rules of inference. Each unit has a single logic associated with it.
- ***Theories*****:** sets of formulae written in the logic associated with a unit.
- ***Bridge rules*****:** rules of inference which relate formulae in different units.

Units define the set of modules (contexts) of agent architecture. *Logics* assign to each module logic used to formally describe the content of the unit. Theories assign to each module a set of facts true in that module. Finally, bridge rules contain the set of rules that specify the interactions between modules. Divide-and-conquer theory sees context as a way of partitioning a global model of the world into smaller and simpler pieces; the second theory called the compose-and-conquer theory sees context as a local theory of the world in a network of relations with other local theories (Bouquet, Ghidini, Giunchiglia & Blanzieri,2003).

1.1.5 Network optimization problems and optimization techniques, efficient algorithms

The PSO algorithm is based on the sociological behavior associated with bird flocking or fishing school. The algorithm makes use of cognitive and social information among the individuals (particles) to find an optimal solution to an optimization problem. PSO is an important swarm intelligent algorithm with fast convergence speed and easy implementation. We start to discover what is the evolutionary computing, as well as what is the genetic algorithm; the concept of PSO (Particle Swarm Optimization) as a part of new methods in computation (Evolutionary Computing), in addition we will describe and analyze the spanning tree and network route optimization, to get the minimal spanning tree, and finally finding the shortest route using swarm intelligence represented in Particle Swarm Optimization (PSO). A network consists of a set of nodes connected together. Each link (path) is assigned a capacity which may be flow, cost, and distance. A path as a sequence of distinct links that join two nodes of the flow irrespective of the direction of flow in each link. If the path connects a node and itself we consider the path to be cyclic and form a closed loop (cycle). A directed cycle is a loop in which all links are directed in the same direction. Nodes which are connected without loop are a-cyclic. In other word a connected network means that any pair of distinct nodes can be connected by at least one path. A tree is connected network without loops (Hassan, 2012).

PSO algorithm is simple and efficient method for optimization and discontinuous multidimensional problems. PSO in general can be used interchangeably with the genetic algorithm, and in some cases, can find solutions faster with less computational overhead. An endeavor was made to reduce the probability of invalid loop/backward path, as well as find the valid and near optimal path with PSO based search techniques with less iteration process. As each particle chooses explicitly its location based on its personal best (pbest) from the set of particle's global best (gbest) in the entire swarm, accordingly the near shortest-path should be chosen in less computation time and of-course with less code (Hassan, 2012).

Genetic Programming (GP): Is an implementation of evolutionary programming, where the problem-solving domain is modeled on computer and the algorithm attempts to find a solution by the process of simulated evolution, employing the biological theory of genetics and the Darwinian principle of survival of the fittest. GP is distinct from other techniques because of its tree representation and manipulation of all solutions. Particle Swarm Optimization (PSO): Similarly to Genetic Algorithms, PSO is a population-based technique, inspired by the social behavior of individuals (or particles) inside swarms in nature (for example, flocks of birds or schools of fish). PSO is a collection of particles or (agents) swarm through an N-dimensional space. The rules for how the particles move through the space are based on simple natural flocking rules that cause the particles to orbit around the best-found solution in the hope of finding a better one. So particles will usually looking forward for the best (optimum) solution. A network consists of a set of nodes (vertices) linked by arcs (edges) and a network optimization models actually are special types of linear programming problems. They can be computed quickly and easily. They provide a way to identify clusters in sets of points. Deleting the long edges from a minimum spanning tree leaves. They can be used to design of telecommunication networks (fiber-optic networks, computer networks, telephone networks, television networks). As an educational tool, minimum spanning tree algorithms provide graphic evidence that greedy algorithms can give provably optimal solutions. PSO is a simple algorithm (method), as well as fast, effective, and can be used in many types of optimization problems (Hassan, 2012).

1.1.6 Network optimization models

The Network optimization models were designed to solve shortest path, assignment, max - flow, transportation, transshipment, spanning tree, matching, traveling salesman, generalized assignment, vehicle routing, and multi-commodity flow constitute the most common class of practical network optimization problems. The core models of network design; such as shortest path models (i.e., node selection and sequencing), spanning tree models (i.e., arc selection) and maximum flow models (i.e., arc selection and flow assignment). These network models are used most extensively in applications and differentiated by their structural characteristics.

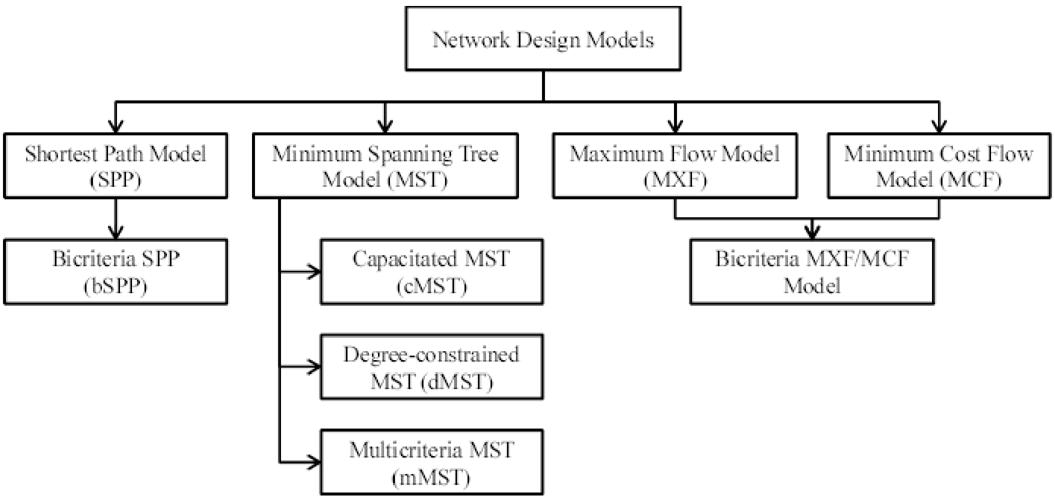

Figure 1.1: The core models of network design.

Connected graph G = (N, A) is given, and it is a structure consisting of a finite set N of elements called nodes and a set A of unordered pairs of nodes called arcs. The descriptions of the models are as follows;

1.1.6.1 Shortest path Model

The shortest path problem holds assumptions like there is a path from the source to all other nodes, all arc lengths are non-negative. The shortest path problem is solved by using Dijikstra's algorithm; creates a tree of shortest paths from the starting vertex, the source, to all other points in graph. Algorithm avoids edges with larger weights (Abiy, 2017). Uses directed graphs and the weights on the links are the costs.

1.1.6.2 Spanning tree model

A spanning tree is a connected subset of a network including all nodes, but containing no cycles. A network is connected if every node can be reached from every other node by a path. An out-tree is a spanning tree in which every node has exactly one incoming arc except for the root. Theorem; In an out-tree, there is a directed path from the root to all other nodes. All paths come out of the root. One can find the path by starting at the end and working backwards. Spanning tree uses undirected graph, weights on the links are the costs. Determines the minimum cost arcs connecting all the nodes in the network (graph) to destination node. This uses *minimal spanning tree algorithm*; initialization of a node (start node) in the network, find edges with the smallest cost, and termination test is done after reaching to the destination node.

1.1.6.3 Maximal-Flow Model

The model has to answer the max-flow problem; is structured on a network, the arc capacities or upper bounds are the only relevant parameters. The goal of optimization is to minimize cost and the maximum flow possible is delivered to the sink node of graph or network. Maximum flow possible is from source node to given sink node is the problem. The algorithm used to determine or compute the maximum flow in a flow network is called Dinic or Dinitz's algorithm. In this algorithm all arc costs are zero, the cost on the arc leaving the sink node is set to -1. The heavy arcs on the minimal cut equal the maximum flow. The arcs on the minimum cut can be identified using sensitivity analysis. Uses the shortest augmenting paths, level graph and blocking flow enables dinic's algorithm to achieve its performance. It has elements; residual capacity, residual graph, augmenting path, and blocking flow. input network, output maximum value, set or update, construct, stop and output, find a blocking flow and augment flow and go back to construct.

Analysis of the algorithm; number of edges in each blocking flow increases by at least 1 each time and thus there are at most n-1 blocking flows in the algorithm, n is the number of vertices in the network. Level graph is constructed by Breadth-first search in O(E) time and blocking flow in each level graph found in O(VE) time. Running time in the algorithm is $O(V^2E)$, for dynamic trees, running time of finding a blocking flow in each phase is reduced to O(E logV), then the running time of Dinic's algorithm improved to O(VElogV).

Minimum cost flow; a directed graph with a source vertex and a sink vertex, each edge has capacity, flow and cost, the most minimum cost flow algorithm support edges with negative costs. Each edge has two numbers (capacity and cost divided by comma). Optimality conditions include; negative-cost cycle, cycle canceling (cycle canceling algorithm) basing on minimal cost-no negative cost cycle (using max-flow algorithm and Bellman-Ford algorithm). Cycle –canceling algorithm is O (VA^2UW) were Bellman-Ford algorithm is O (VA). Mean cost of a cycle C is its cost divided by its number of arc: minimum mean cycle is a cycle whose mean cost is as small as possible. Reduced cost optimality condition. Minimum cost flow uses successive shortest paths algorithm(involves excess of nodes, deficit of nodes and node balanced), flow is send from node with excess supply to a node with deficit demand, along the shortest path. Minimum cost flow involves the primal simplex algorithm (node-arc incidence matrix of a connected digraph D). Minimum cost flow includes capacity scaling; (variation of successive shortest path algorithm, Reduced maximum number of iterations to obtain a polynomial-time algorithm, Δ- scaling phase, series of iterations where the flow sent through the path is at least Δ (parameter). If no node has excess of least Δ, or no node has deficit of at least –Δ, reduce Δ by a factor of 2. Δ=1 at the end of the phase with Δ= 1the algorithm terminates with feasible flow). Capacity scaling algorithm terminates with an optimal flow within O (log U) scaling phases (with Δ=1). Minimum cost flow also consist of minimum mean cycle algorithm (variation of cycle –canceling algorithm with strongly polynomial bound. At each iteration select the negative cycle with the minimum mean cost, minimum mean cycle can be found in O (VA)).

1.2.0 Theories about information society

The new technologies are the most leading indicators of the new times we live in today, these are the signals of the coming world of information society as many countries are turning to information as resource than minerals being exhausted, societies are becoming service oriented than industrial based. Never the less information is needed in all the sectors of the Governments. Many countries are struggling to adopt technologies; the technologies and information spread usage have led to the birth of intelligent information systems and automated systems. The volumes of technologies like computers, satellite television, Networks and Telecommunication, office automated information systems, online information services, software developments, internet spread with the volume of technological innovations have led to reconstitution of social world and change the style of living. This is pushing countries into information societies; this brings a systemic social change according to Evans in 1978.

In the spread of ICT (information communication and technology), promoted rapid growth of the capacities of economics success, education and democratic process, and advances have been made in telecommunication to gear the world information exchange and connectivity. Data is collected on internet taken across nations systems to lead development and innovation (hence growth to global brain) used by heaviest users of information and earliest adopters such as Finland, south Korea, United Kingdom and Europe, while United States of America regarded as more information societies than the others countries Rwanda included.

1.2.1 Daniel Bell's theory of post-industrialism or post-industrial society (PIS)

Focused on the role of information/Knowledge, and use of development in computer and communications technologies. Explosive technological changes experienced by advanced societies, sudden arrival of new technologies which rapidly permeated into offices, industrial processes, schools and the home. An urgent search to discover where all these changes were leading to information societies. The massive expansion of these information technologies and computer communications technologies led societies to a change (information revolution). Bell argues that information and knowledge are crucial for PIS both quantitatively and qualitatively. Information has played a greater role in social, economic and political affairs, this signaling a new type of society (Post-industrial or information society). This brings real social trends in social relations. Bell suggested that United States led the world on a path towards a new type of system (Post-industrial society).

Bell insists that it is ongoing as we enter PIS – we are assured of: a decline in the number of workers employed in industry, ultimately reducing to a situation where very few people find work there (the era of 'robotic factories', 'total automation'), accompanying this decline in industrial employment, continuing and sustained increases in industrial output because of unrelenting rationalization and continued increases of wealth, translated from industry's output, which may be spent on new needs people may feel disposed to originate and fulfill (anything from hospital facilities to masseurs); continuous release of people from employment in industrial occupations, creation of a never-ending supply of new job opportunities in services aimed at fulfilling the new needs that more wealth generates (i.e. as people get richer they discover new things to spend their money on and these require service workers). The core role of information is the initial resource to service economy (as post-industrial society), this requires information workers that will involve in information activities.

1.2.3 Regulation school theory

As put forward by Robert Boyer, transformation of social relations, which creates new forms of both economic and non-economic, organized in structures and reproducing determinate structure, and mode of reproduction basing on input of information flows. According to the Columbia University Press, 1990; capitalist economies are function of social and institutional systems.

1.2.4 Fordist/Post-Fordist theorizations

Fordist era of mass production led to globalization, massive production due to increase of knowledge and information intensively. The era brings up the birth of Brain power industries such as biotechnology, media production and computer software as the sure bet in a global economy, were cheap labour is abundant, cost of production are minimal. Robert Reich argues that people in fordist era are problem-solvers, problem-identifiers and strategic brokers located in Jobs such as banking, law, engineering, computing, accounting, media, management and academic. All these jobs hold in common are informational. Information labour is always capable of retraining itself, alert to the latest.

Fordism/Post-Fordism (involves intellectual circles in relation to information) can considered as post-industrial theory. Explained why a decline of work in factories and shift to service occupations such as finance and leisure. Information inflows flexible specialization and information communication technologies facilities and expressed flexibility. New technologies are intelligent, their feature being incorporate considerable quantities and complexities of information. Information inputs determine the degree of flexibility, enabling, cost-effective, small-batch production runs, customization of products and rapid changes in manufacturing procedures(worker possess information/knowledge of the system as a whole. Information technologies are a post-industrial technology). Information age developed ways of working-global webs. Flexible specialization suggested that work is information-intensive and higher skill levels.

There is a transition from fordist to post-fordist regime of accumulation and mass production has given a way to flexible specialization, premise that capitalism is a dynamic form of economic and social arrangement, the collapse of communist regimes and attempts to replace with market-based systems.

1.2.5 Manuel Castells theories

According to Manual Castells argues that information Age announces a new society, due to development of networks (enabled by information communication Technologies) and give priority to information flows. Information capitalism describe the present epoch. Castells argues emergence of network society or networked society, our societies are undergoing transformation towards information age (due to spread of networks linking people, institutions and countries), integration of global affairs. Information mode of development is associated with growth of information and communication technologies, massive information work has increased throughout the society. Network society means people must get used to being flexible. Time-space compression (timeless time), social movements involves purposive collective actions transform values and institutions of society. Informational labour is the central to the new world system.

Peter Drucker's in 1993 believed that knowledge experts are central resource of capitalism (knowledge society), Castells argues that informational labour is that range of jobs which generate change.

1.2.6 Information and democracy

Information has changed the public sphere. Tumber in 1993 argues that information management is fundamental to the administrative coherence of the modern government. The reliance on communications and information has become paramount for governments in their attempts to manipulate public opinion and to maintain social control. Giddens in 1985 argued that modern societies are information societies since their inception. All states have been information societies, generation of state power presumes reflexively gathering, storage, and control of information, applied to administrative unity, brought to a much higher pitch than ever before. Modern world is made up of nation states which are information societies and networked to form globalization, nation states are moving from industrial warfare to information warfare leading to development of durable systems of command and control to coordinate, assess and oversee these resources. Computer communications infrastructure to handle and protect information flows. Knowledge warriors, perception management, sophisticated technologies and technologies of cyber war are information saturated, leading edge of industrial innovation for military purposes and other sectors of life for example; Electronic Engineering, Computing, telecommunications and aerospace and surveillance.

1.2.7 Requirements for intelligent system technologies to support information society

The requirements are derived from the theories; internet and connectivity, network technologies, information communication technology, Network optimization models, intelligent systems, efficient algorithms for Networks, optimization techniques, Bridge rules, intelligent system theories and information society theories, context-sensitive applications and interfaces, global model, logics, Units (Main components of architecture), flexible formal tool for systems of autonomous agent, translators and interpreters of languages, design of intelligent agents, computer communication infrastructures, informational skills, maximum likelihood estimator, decision surfaces and spam blockers and electricity. A combination of all these mentioned requirements builds up efficient intelligent system technologies that help a society to transform into information society.

2.1 The outcome of the theories linked to usage of intelligent system technologies as core for information society

It has led to transformation of society from industrial into service oriented (market-based systems) and as information society, massive production, increasing innovative power and providing employment to people with informational skills and knowledge empowerment, development of durable systems, social networks and promoted globalization, emergence of Global Brain and cashless economies, smart government services in all sectors of life using intelligent systems technologies. Structural transformation of the Public Sphere (information is at the core). National incomes rise, durables like clothing, housing, automobiles, luxury items, recreation. The personal services begins to grow like hotels, auto services, travel, entertainment, sports and peoples horizons expand, new wants and tastes develop. The social change in nation states cultural dimensions and political sphere of the world (social transformation).

2.1.1 Application of intelligent system technologies as core for information society

The industrial Networks and intelligent systems development is using information technologies like social networking; cloud computing (intelligent systems), big data, cyber-physical system and ubiquitous, mobile computing. Communication technologies; control network, communication network, sensor networks, body area networks, social network, opportunistic network, and cloud-based network. Analysis of industrial control and communication networks like; network lifetime, security, network scalability, reliability and stability. Opportunistic network; underwater sensor networks (sewage treatment systems-underwater robot, surface data station, surface data station, surface sink and under water sink). Application of intelligent systems in varies industries and offices, collaborative systems, quality control, optimization, decision support, planning. Real-time embedded industrial systems, Automated manufacturing systems, Computational intelligence in automation. Big data analysis and processing, Crowd – sourced behavior analysis, Simulation and testbed of current industrial networks and intelligent systems(network performance analysis, automated manufacturing, intelligent monitoring, disaster prevention), Smart factories, Multimedia applications, content management, process management and knowledge management in various industries and services (Duong & Bao, 2016).

2.1.2 Challenges of intelligent system technologies as core for information society

Research in intelligent systems technologies faces numerous challenges, many of which relate to representing a dynamic physical world computationally. Uncertainty: Physical sensors/effectors provide limited, noisy and inaccurate information/action. Therefore, any actions the system takes may be incorrect both due to noise in the sensors and due to the limitations in executing those actions.

Dynamic world; the physical world changes continuously, requiring that decisions be made at fast time scales to accommodate for the changes in the environment. Time-consuming computation: Searching for the optimal path to a goal requires extensive search through a very large state space, which is computationally expensive. The drawback of spending too much time on computation is that the world may change in the meantime, thus rendering the computed plan obsolete. Mapping; a lot of information is lost in the transformation from the 3D world to the 2D world. Computer vision must deal with challenges including changes in perspective, lighting and scale; background clutter or motion; and grouping items with intra/inter-class variation. Many systems lack smartness (due lack of knowledge-base and intelligence), connectivity, electricity and energy distribution in many world national states like Asia and big part of Africa, the network or system lacks intelligence (doomed to failure and being static),. Whoever the mentioned challenges can be solved by use of techniques; genetic algorithms, ant colony optimization, swarm intelligence, fuzzy logic, neutral network, reinforcement learning, use of these techniques given generation of next systems as perfect combination of speed and intelligence, Information communication technology infrastructure, electricity, telecommunication, political willingness towards intelligent systems technologies, information skilled labour, educated citizen and Research combined with innovation. Finally all mentioned solution leads to information society (market-base-system).

3.0 Typical trend of transformation of societies into information society supported by intelligent system technologies

The trend in transformation of nation states towards information society was in the report of 2017 produced by ITU.

The United States of America has transformed society, culture and economy operations (circulation and production of information is the social and economic activities), rapid spread of ICTs (internet communication technologies like; internet, cell phones, wireless networks as a key of the functioning of the society), rely on communication technologies. As shift from manual labour to mental labour or good-based to knowledge-based (producing information, usage of computer and software). United States of America is in information age and internet technology led people communicate in real time. According to ITU report of 2017; Telecommunications is a well-established sector in the United States, with all segments under competition and penetration levels that are among the highest encountered for all services. Service pricing is extremely competitive in the United States, representing a mere fraction of regional and global averages. Despite being at a substantially more advanced development stage, the telecommunications sector in the United States still has barriers to overcome, notably the digital divide represented by the diverging access to broadband between urban and more remote areas in the country. Investment and infrastructure development remain a constant in the sector, as operators strive to employ new telecommunications technologies and provide better service. Aside from the traditional public–private partnerships, tech companies have also partnered to roll out state-of-the-art networks, such as Facebook and Microsoft uniting forces to build the MAREA, a submarine cable across the Atlantic (ITU, 2017).

The United Kingdom has a highly advanced telecommunication market, characterized by its early liberalization and a fiercely competitive environment. Penetration rates are high for fixed and mobile services and prices are affordable. A champion of liberalization, the United Kingdom has developed into one of the world's leading countries for telecommunications. ICT household penetration is high and most people living in the United Kingdom are online.

Uruguay's telecommunications sector has demonstrated remarkable development over the past decade, especially in terms of universal access. Bridging the national digital divide has been a priority for the authorities of Uruguay, ensuring that the clear majority of households have broadband access. The Government has made efforts to guarantee that low-income groups have access to the Internet. In fact, Uruguay has the highest percentage of households with computers in the region and, in a study of the population aged 14 years or above who have access to the Internet, 96 per cent are believed to use it at least weekly and 84 per cent daily.

Singapore; The island nation has striven incessantly to be a regional ICT leader. Its proactive Government ensures that the nation remains at the forefront of technology, with widespread access and low prices. Singapore has long had ongoing ICT plans that are adapted to industry changes and thus effective and relevant. The competitive ICT market ensures that the country continually adopts the latest technologies. The result is a country that is a global leader in connectedness to ultra-high-speed broadband networks.

Russian Federation; The telecommunication market is dynamic and operators offer innovative technologies and services. Despite the large territories to cover, telecommunication services are accessible to the majority of the population while prices remain at relatively low levels. The Russian Federation has a vibrant telecommunication market. The regulatory authority aims to overcome the digital divide between regions and provide the population with modern telecommunication services by creating a favorable competition environment, adopting regulations and supporting infrastructure renovation.

Qatar is a rapidly developing country and has a highly advanced ICT infrastructure. Ooredoo (formerly Qtel) and Vodafone offer advanced fixed and mobile services with some of the lowest prices in the region. Additionally, Qatar National Broadband Network (Qnbn) offers passive fixed services on a wholesale basis, Harris Salam, QSAT and RIGNET offer VSAT services, and Es'hailSat offers public satellite services.

China is the world's largest telecommunication market in terms of the number of mobile, fixed-telephone and fixed-broadband subscriptions, as well being as the leading exporter of ICT products. A mix of government direction, private sector operation, and a large ICT manufacturing base has forged China's rapid telecommunication development, establishing it as the largest telecommunication market in the world.

Japan is an ICT leader, not only in terms of developing, piloting and adopting the latest technologies, but also as an active participant in international standards setting bodies. Government planning, R&D investment and sophisticated consumers have contributed to Japan’s rapid adoption of the latest technologies and to its achieving extensive high-speed ICT coverage.

India; this large market is evolving from a fragmented regional service provision environment to one characterized by increasing industry consolidation and nationwide operators. This large nation is a leader in ICT enabled outsourcing services. The Government’s efforts in extending fibre-optic backbones to rural areas and enabling greater economies of scale is expected to result in lower costs and greater affordability and likely to narrow the gap in ICT access between rural and urban areas.

Republic of South Korea; the government has promoted the sector through ongoing strategies to ensure that the country is a broadband leader. Eager consumers, competitive markets and strong links between the research community, hardware manufacturers and service providers facilitate this statusThe Government has been successful at guiding the nation towards ever-higher levels of informatization through ongoing strategic plans. This is reflected in the figure of 93 per cent of citizens aged three years and over using the Internet in 2016.

South Africa; With the most advanced ICT networks in sub-Saharan Africa, South Africa is striving to enhance its digital capacity by moving to the highest possible broadband speeds. South Africa is at the forefront of the region’s technological development with the latest broadband technologies and wide coverage. This has been enabled by a suitable regulatory framework and a competitive private sector-driven market. Cost remains an issue due to significant duplication in backbone networks, with a need to move to a cost-based open access regime.

Nigeria is sub-Saharan Africa's largest economy, providing huge potential for developing the ICT sector. There is a high level of retail competition in the mobile market. This needs to be extended to the retail fixed-broadband and wholesale backbone markets so that high-speed connectivity can extend to all parts of the country and meet the needs of business and government.

Kenya's Government has long recognized the importance of the ICT sector for achieving national development goals, and has undertaken the necessary steps to create an enabling environment. This includes playing a leading role to obtain the country's first undersea submarine cable. With a vibrant and innovative ICT sector, the nation is emerging as the digital hub for the East Africa region.

Tanzania has created an enabling environment through a predictable regulatory environment, competition and open access to backbone networks. This is resulting in growing access to ICTs.

Uganda; the landlocked East African nation has a forward-looking regulatory framework, but faces challenges extending broadband coverage and services to the largely populated rural zones. Uganda has one of the most progressive ICT sector policy and regulatory environments in Africa. However, the country faces large challenges to developing widespread infrastructure access, due to its sizeable large rural population and low disposable income.

Seychelles; the Indian Ocean archipelago is the least populated nation in Africa, with one of the highest levels of ICT access in the region. The Government has installed a predictable regulatory framework and generated a realistic degree of competition in the ICT sector given the country's small population. It was proactive in creating a public–private partnership in order to procure a critical undersea fibre-optic connection. These strategies have resulted in Seychelles having some of the highest ICT penetration rates in sub-Saharan Africa.

Rwanda; the Government of this landlocked East African nation has been proactive with its strategic vision for the sector, and the country has achieved one of the highest levels of mobile-broadband coverage in sub-Saharan Africa. Government steps of creating a regulator, privatizing the incumbent, introducing competition and developing a broadband strategy have resulted in a high level of broadband infrastructure in the country. The SMART Rwanda

Master Plan envisions taking ICTs to the next level by using their transformational capabilities and developing a vibrant ICT-enabled sector.

Despite all the strategies lied to widen the intelligent systems technologies, ICTs and telecommunication in Asia and Africa many urban and remote areas (rural) do not have these infrastructure, national states have a long way to go into information society.

4.0 CONCLUSION

Finally, some Nations and large-lands of the world have to employee the combination intelligent systems technologies, Internet and Communication Technologies, techniques/ algorithms, electricity, education, advanced telecommunications, high speed connectivity and providing internet and telecommunication services at low-price to households so as to transform our societies into information society(service oriented) and to have globalization. This information society empowers the research and innovation leading to smart and massive production, cut cost, increase competition in the region, intelligent system technologies support usage of information systems in all sectors of life, easy access to services and social change, culture and political sphere change, more dissemination of information and easy movement of resources and integration of economics. For Asia and Africa there is a need for ICT, electricity, educating all the citizens, and development of infrastructure and to employee intelligent system technologies to transform agrarian, industrial to information and SMART nations states. Rapid growth usage of intelligent systems technologies is an indicator of a nation state in an information society or information age with the following advantages; involved ability to transmit and receive digital data rapidly between places, shift from manuel labour to mental labour, massive production, efficient and effective intelligent systems development, social cohesion and political sphere change due information sharing, and created social networks transforming all the facet of sector operations and change in the style of living, leading research and innovation, renovation in industial and services. Intelligent system technologies the core of information society.

5.0 RECOMMENDATIONS

The challenges and theories discussed in this study showed that without internet connectivity, electricity or energy, information skills, intelligent systems technologies, telecommunications, ICT infrastructure and political willingness, national states can to transform their societies into information societies (information lobour). Without using intelligent system technologies slows research, innovation and leads to low pace in development of services, durable goods and systems. Information society maximizes productivity and creates employment for information skilled personnel. Techniques exposed in the study must the building tool to use as intelligent information systems are being put in place. Intelligent system technologies are the core of a real information society in national states.

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