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A Framework Of Smart System For Responsible Decision Making In Inclusive Workforce Management: A Qualitative Ethnographic Study

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1.0 Introduction

For many years' business and management have been the focus of Information systems research with applications of information systems and information technology. Responsible Research in Business and Management has created (Owen et al, 2012) awareness for more socially relevant research by research community. There are unprecedented technological changes: Uber the world's largest taxi company, owns no vehicles. Facebook, the world's most popular social media owner creates no content. Alibaba, the most valuable retailer, owns no inventory. Apparently information technology is creating an enabling work environment for all (Moqbel et al, 2017)

This paper discusses the application of Information Technology for design of a system for enablement of mentally disabled employees hired by a manufacturing organization

Authors have used qualitative ethnographic research (Hammersley,1992) (Hammersley et al., 2019) to study the case of Sharayu Precision and Associated Manufacturing Company (Sharayu Precision and AMC) (an automobile spare parts manufacturing company) located at Chinchwad, Pune, India, which hires mentally and physically disabled employees to improve the productivity of the organization. The study extends to use systems research to create a comprehensive view for information origination under uncertainty, leading to a framework for the design of smart systems (Systems Innovation, 2019) with the capability to make responsible decisions for the creation of a conducive work environment for mentally disabled employees. Though Sharayu Precision and AMC has been hiring both mentally

and physically challenged employees, authors are focused on mentally challenged employees as physically challenged may be included in the workforce for appropriate jobs (like assembly, polishing) and treated like ordinary employees. However, the same is not the case with cognitively challenged employees who have an ailment of Autistic Spectrum Disorder (ASD).

1.1 Information Systems in responsible decision making

Cecez-Kecmanovic et al. have published that Information Systems research can offer new mechanisms for improving organizational performance in a measurable way such that human beings are treated as an information resource. Cecez-Kecmanovic has written that "IS for enabling and assisting new forms of control and organizing is not directed at a vision of the organization as a community, but rather at turning it into an efficient machine to realize measurable purposes". Also that "They are brought together to control human beings in much the same way as other resources (money, raw materials or natural environment), albeit in a subtler and covert form – through 'technical codes.' These codes are information engineering, software code, algorithms, rules, and procedures. " (Cecez-Kecmanovic, 2008). Cecez- Kecmanovic states that 'Information Systems may offer methods to advance the organizational deliverables using human beings' characteristics as an informational element, which aids in responsible decision making.'

Social inclusion can be defined as "the extent that individuals.are able to participate in society fully and control their own destinies" (Warschauer 2003, p. 8). Andrade et al. have described Information Communication Technology (ICT) not as a tool but as a vehicle for social inclusion, which is imperative for refugees to settle down in new land, similar to involving the diversified workforce in the work community of an organization. Orlikowski and Baroudi have published that, "the design and use of information technology in organizations, in particular, is intrinsically embedded in social contexts, marked by time, locale, politics, and culture," (Orlikowski, Baroudi, 1991), thereby implying that information technology framework may be used to resolve the culture issue in communities and the given context may be applied to workplaces.Also, the principles of responsible science as per the position paper published by Responsible Research in Business and Management (RRBM Position paper, 2019) has

published that the responsible research should be on the principles of service to society, stakeholder impact and involvement, multidisciplinary and on sound methodology.

Within above construct, the framework outlined in this paper below (for the under consideration workforce management performance desired) proposes to identify information variables to be culled out. These information variables should be originated continuously in real time, for creating a smart system (Rochford, J. 2019) This smart system will be used for responsible decision making, in order to create a conducive work environment for employees with Autistic Syndrome Disorder(ASD) (whole workforce creation) (Heera et al., 2017) so as to contribute effectively to the organization and for the organization to leverage the skills of their diversified workforce. In totality this will create benefit to the society at large, too (Djamasbi et al, 2019)

At a more transactional level smart systems imply dealing with a large quantity of data also

It is essential to interlink the smart systems to be made responsive so that the decision making in different situations is not only smart but also advantageous to business and social context. For smart and responsible information systems to exist, their design template must be created. Also, it will need to incorporate the viewpoints of its broad range of stakeholders. Such higher-level policy and the societal arrangement would lead to the recognition of responsible ways to address societal issues in the interest of the researchers and organizations. The engagement with ethical questions requires the development of reflective processes within research, so that norms, their context, and application can be understood, predicted, and influenced (Bernd Carsten Stahl,2012).

2.0 Literature Review -Inclusive workforce recruitment for diversity management in Global scenario

Kenneth J Barett, global chief diversity officer for General Motors Co., agreed that GM recognized the power of diverse talent and perspective and hence had an inclusive recruitment strategy to foster innovation. Rod Adams, the talent acquisition leader at PwC LLP, said that embracing diversity and inclusion leads to happier employees and stronger teams which deliver better (INSIGHT into Diversity, 2017) (Armstrong,2018). Inclusivity has been further defined as disability inclusion; an analysis report on NIFTY companies in India stated that disability inclusion in the workforce contributes significantly to the culture and success of an organization and may provide an impetus for sustainable competitive advantage (Heera et al., 2017). People with disabilities are India's single most significant minority. In India, there are 26 million people with disabilities, and only 37.6% are employed (World Bank, 2011), also in India, disabled people do not have many facilities hence may not be highly educated (Echevin, 2013). Rahim and Ademola defined diversity management as an equal opportunity approach where employment should be provided on merit, where the failure or success can be attributed to employees' capabilities and not the environmental/organizational context. Diversity in the workforce may be attributed to gender, age, ethnicity, sexual orientation, race, education, religion, geographical origin, income, marital status, profession, function, physical condition. However, organizations must develop an organizational structure, leadership style, and business practices to manage diversity to positively contribute to the holistic growth of the organizational system (Rahim, Ademola, 2017) (Annabi, Lebovitz, 2018)

Michael Cafferkey has demonstrated through examples of the situations where the disabled workers had been hired to bring the whole community into the workforce. In his paper, he has cited the examples of Signs restaurant in Toronto, Canada, Sugar & Spice extraordinary sweet treats in Evanston, Illinois, and Prospector Theatre in Ridgefield, Connecticut. At Signs, 50 deaf people have been employed as servers. Signs restaurant has been successful in bringing the margins of society to the core of the organization; thus contributing to the economy and expanding the opportunities for the whole community. Sugar & Spice's excellent sweet treats bakery has hired autistic employees as a sales clerk, bakers, and workers. The community of Evanston, Illinois, is pleased with the bakery and enjoys sweets from the shop. Prospector theatre also hires people, who are autistic, for selling tickets and concessions along with other tasks. From the organizational point of view, expanding the workforce to include people with disabilities requires restructuring of reporting relationships (Cafferky, M., 2016).

Pless and Maak have written that "Diversity is first and foremost a cultural question and thus a question of norms, values, beliefs, and expectations." They further added that the diversity management should be institutionalized. For institutionalizing, a culture of inclusion should be established that fosters enhanced workforce integration. The culture of integration can be built by developing an organizational culture that allows people with diverse backgrounds, mindsets, and ways of thinking to work effectively together to achieve the organization's objectives. Thus it becomes essential to identify a process to create this culture starting with the definition of the framework of inclusion built upon principles identification of positive goals (a.k.a principles of recognition, mutual understanding, standpoint plurality and enabling), which may be further broken down into sub-goals and decision-making processes therein (Pless, Maak, 2004).Neil Parmar has written that "as companies discover the value of having autistic employees, many are making changes to their hiring processes. Almost 50 companies in the US have a workforce primarily made up of autistic workers." He further adds that companies are not per say acting out of a sense of

social responsibility, but as they are looking forward to the untapped talent pool. The Director of JP Morgan has described some characteristics of autism as "ideal assets in the workplace, particularly in industries like tech and engineering." However, it is imperative that these companies, which are hiring employees with neurodiversity, need to create processes to engage and offer them a conducive environment (Wu, J., Lederer, A.,2009) for work (Parmar, 2017).

Wong et al. have written that, when autistic employees do get a job, the bullying at the workplace is a serious concern; they further add that there are multiple barriers to performance at the workplace for autistic employees. Employment participation of people with autism remains a critical area that is mostly unaddressed. Minimal emphasis has been laid upon management models in order to resolve the issue of employment participation for people with disabilities and the complex interactions between the embodied experience of impairment and organizational practices (Wong et al., 2018).

Lorentz and Heinitz had written that people with Autistic Spectrum Disorder (ASD) are in demand for their obsessive “concentration during long-lasting routine work, identification of logical rules and patterns, processing visual information and the ability to remember facts” (Lorentz, Heinitz, 2014). L.C.Capo had concluded that persons with autism could be successful in the workforce with adequate support. Adequate support would need to include an interdisciplinary team (Capo, 2001). Hensel had published in 2017, that the population of children diagnosed with autistic spectrum disorder(ASD) had risen significantly by 78% from 2007. Nearly half of the individuals diagnosed with ASD had either average or above-average intelligence; however, only a small percentage was employed. This situation presents an opportunity to expand the workforce and offer opportunities to utilize the strengths of autistic people. However, the challenge of the integration of people with ASD in the organization remains. Hensel has proposed a legal framework in the USA for employing individuals with autism (Hensel, 2017).

Microsoft also has a unique hiring program for people with autism and other disabilities. It has introduced the same to increase diversity in the workplace and to leverage the particular skill of people with autism (Microsoft.com, 2020)

Apart from Microsoft, other companies in the USA which have full-fledged programs for the hiring of people with ASD are Freddie Mac, SAP, AMC Theaters, JP Morgan Chase (The Mighty.com, 2020).

From above, it emerges that the recruitment of persons with ASD is beneficial for the organization from the perspective of hiring people, who will contribute to various functions in the organizations suited to their capabilities. However, the challenge remains of identifying an automation based framework to assimilate their presence in the fabric of the organization system, with a view to aid productivity of the organization.

3.0 Context and Research Design-Ethnography in qualitative research

Scott et al. published that "ethnography in qualitative research is used to study social interactions, behaviors, and perceptions which occur within groups, teams, organizations, and communities. The central aim of ethnography is to provide rich, holistic insights into people’s views and actions, as well as nature (that is, sights, sounds) of the location they inhabit, through the collection of detailed observations and interviews" (Scott et al., 2008). Hammersley wrote that ethnographers study the culture, perceptions, and processes in the environment in which people live; it is about understanding the way people perceive the world from where they are. (Hammersley,1992) (Hammersley et al., 2019). Kensing et al wrote that , “ethnographic studies focus on achieving such a shared view on the work and provide insights into the work’s unarticulated aspects by applying openended (contextual) interviews and participant observations “(Kensing & Blomberg, 1998), (Tarkkanen et al , 2019)

3.1 Sharayu Precision and Associated Manufacturing Company

This study was conducted in a small company dealing in automobile spare parts manufacturing. The company is called Sharayu Precision and Associated Manufacturing Company (Sharayu Precision and AMC), it is based out of Chinchwad , Pune in the state of Maharashtra in India.

India the second most populous country in the world and the largest democracy in the world in South East Asia. The country is divided into states and union territories. States are further divided into districts and further smaller units like talukas. It has 28 states and 8 union territories. As per the census of 2011, India had a population of 1,210,193,422 residents. India has the largest number of people living below the poverty line of USD 1.25 per day as per World Bank. (Alam, 2020).

Sharayu Precision and AMC is in the state of Maharashtra in Pune district. Maharashtra is located on the western region of the country. It is the most industrialized state in India, it boasts of many small scale industries and export processing zones. It also has a large base of skilled and industrial labour making it a favored destination of knowledge and manufacturing industries. Maharashtra’s Gross State Domestic Product (GSDP) at current prices was Rs. 32.24 trillion (US$ 467.38 billion) in 2019-20. GSDP of the state increased at a CAGR (in Rs.) of ~13.16% from 2015-16 to 2019-20. The state has emerged as a key hub for IT & ITeS, electronics, and captive business outsourcing industries. The Government of Maharashtra is promoting the development of several Special Economic Zones (SEZs) across Maharashtra for sectors such as IT/ITeS, pharmaceuticals,

biotechnology, textile, automotive and auto components, gems and jewellery, and food processing (IBEF, 2020).

Pune is a district in Maharastra, is located 118 km from Mumbai (capital of Maharastra) situated 1,837 feet above sea level on the Deccan plateau. This city is known as the cultural capital of Maharashtra. It places emphasis on education, arts and crafts, music, and theatre. Pune culture reflects a blend of tradition with modernity.

Chinchwad is part of Pimpri Chinchwad Municipal Corporation and is part of Navi Pune (New Pune). Navi Pune is a unique blend of sustainable residential spaces, highly advanced transportation networks, a broad spectrum of employment opportunities, modern housing typologies such as township properties and superior supportive infrastructure.

Sharayu Precision and AMC employs people with ASD, which is a very unique practice. In fact it has claimed that by employing workforce with ASD, the processes have become more effective and has benefited the company. It is an automobile part manufacturing unit. Its gross turnover for the year 2002-03 was over Rs 1,15,000. It is an exceptional unit, as 25% of its workforce is mentally and physically challenged. In 2002-03 out of 140 employees, 36 of its employees are physically and mentally challenged. They work at jobs ranging from riveting, drilling, and greasing to polishing and packing. Mr. Subhash Chuttar is the founder and managing partner of this company. As a policy he recruits from the school of mentally challenged, he was awarded the Helen Keller award in 2003 instituted by the National Centre for Promotion of Employment for Disabled People.

In 2017 the company had three partners namely Mr. Chuttar, Mr Jain and Mr. Shah and the company has reported a revenue of Rs.65.48 crores (Rating Update, 2019)

"The normal assumption everyone makes is that mentally or physically disabled people are incapable of any work. They are often seen as a burden on society. The truth is that they can be more productive than normal healthy people because their level of concentration is always very high, and their minds are never cluttered with distractions," said Chuttar (Huned Contractor,2004) (M.Bhavsar, 2017)

3.2 Data Collection

In order to create the framework of a smart system for amalgamating the presence of ASD employees in the workforce, we adopted a case study approach and focused on a privately owned automobile spare parts manufacturing company as mentioned above.

In oder to collect data vis-a-vis effectiveness of ASD employees, their contribution to the business and the processes in which they work, authors conducted several ethnographic interviews.

The people to be interviewed were identified on the basis of their stakes in the company. This included Mr. Subhash Chuttar, founder and managing director of Sharayu Precision and Associated Manufacturing Company (Sharayu Precision and AMC) at Chinchwad, Pune, India, also he is the visionary behind the project. Other key stakeholders were the ASD employees, normal employees who worked in the organization, Mr. Amit Chuttar and Mrs Jyotsan Chuttar (wife of Mr. Subhash Chuttar and mother of Mr. Amit Chuttar) The interview with Mr. Chuttar was conducted at the company premises and at his home, where the authors spent 12 weeks studying the company. The study focused on inclusive work environment comprising of a diverse workforce of mentally and physically disabled people in Sharayu Precision and AMC. It also recorded family members' opinions on the engagement created for them. The work environment was studied during the work days on the shop floor. The perspectives of an inclusive workforce hired by Sharayu Precision and AMC have also been captured in a video documentary. Mr. Chuttar has said in the interview that there is a need to create separate processes for hiring people with cognitive disabilities in the organization, also to provide them with an encouraging, conducive work and work environment.

Mr. Chuttar has demonstrated that his decision for working with an inclusive workforce has been successful as his company expanded to include 40 mentally challenged employees and was improving the profitability.

In order to conduct the ethnographic qualitative study one of the co-authors were stationed in Cinchwad to observe the engagement of mentally challenged workers and assess their productivity in the organization, in their natural setting (Atkinson, Hammersely, 1994).It was observed by the him that mentally challenged workers did work on technical jobs like orbital riveting for lock assembly work, drilling, reaming, tapping, greasing, sticker pasting, press operation, material handling related to press shop, lightweight material loading and unloading, tasks involving putting things together and job inspection. Some mentally challenged, senior workers even do higher-level jobs related to dispatching inspection report and quality checks. They are also introduced to the Internet in an introductory way, access e-mail. Mentally challenged employees may be viewed as worker-learners with information processing variability from that of incumbent worker-learners. The co-author in this paper, has also used the same as a basis for introducing a master's level course on emerging knowledge discipline, namely, Learning Engineering at the university in India he works.

Table 1 presents a summary of the individuals' interviewed and focus group participants.

Table 1

Sno	Name	Role in company	Gender	Profile
1	Mr. Subhash Chuttar	Founder and Managing Director	Male	Businessman
2	Mrs. Jyotsna Chuttar	Wife of Founder and Managing Director	Female	Housewife
3	Mr. Amit Chuttar	Employee and son of Founder and Managing Director	Male	Mentally challenged employee
4.	5 participants One focus group	Colleagues of ASD employees	2 male +3 females	Employees
5.	13 participants from different departments-ASD employees	Employees	7 male +6 females	Employees

Table 2.0 Profile of the interviewees and data sources

Number of interviews	Position/Job title	Length of service in SPAMC	Observation of work during the course of data collection	Additional information
1	Manager	5	yes	Informal conversation to understand the work processes like managing the production planning and people
2.	HR person	10	yes	Informal conversation on HR processes like salary disbursal, leave, working hours of employees, training
3.	Machine maintenance person	10	yes	Informal conversation on maintenance of machinery
4.	Workplace maintenance team	15	yes	Informal conversation on maintenance of machinery
5.	Healthcare team	17	yes	Informal conversation on employee health

In this paper, authors have extended ethnographic qualitative study into systems engineering driven information processing based approach to propose a framework for creating a smart system (Systems Innovation, 2019) aimed at making responsible decisions (Principles of Responsible Science, 2019) to create a favorable work environment for organizations to generate inclusive workforce for diversity management.

It has been estimated that more than 2 million people might be affected by ASD in India. There is not enough data to substantiate the exact prevalence of ASD in India. There is an under-recognition of disorder due to the absence of diagnostic tools and mechanisms (Chauhan et al., 2019

In the Indian corporate scenario, only very few American multinational companies have broached the subject of hiring employees with ASD, other companies have maintained silence on the aspect. It was only in 2014 that the Personal and Disabilities bill was introduced in the Indian legal system, which recognized ASD as a disability along with 19 other physical and mental conditions (CIO Archives, 2018). In India, only through non-government organizations and small companies like Sharayu Precision and AMC) have created job opportunities for people with ASD. Thus it is of prime importance to create a framework for inclusive employment of people with ASD, and it should be done to leverage the workforce for the company by diversifying the same.

3.3. Data Analysis

All data collected through the ethnographic process explained above was collected through recordings, observations and hand written notes. The processes outlined by Strauss and Corbin (1998) and Miles and Huberman, 2013) were referenced.

The data was studied with a view to find a pattern and a set of processes with descriptive keywords were prepared. The coding process of data sheets was as follows- open coding was used for first level of conceptual analysis. Line by line analysis of transcripts was done to identify different properties of the proposed smart system. As a result of open coding several decision stages were mapped to the findings of ethnographic study for example:

- cost of hiring an autistic employee
- contribution in quality and quantity of production
- interpersonal issues in employees with ASD.
- reporting time of employees with ASD
- delivery hours of each employee with ASD
- maintenance of machinery and workplace
- managing health of employees with ASD.

These are detailed in section 7.0 below.

Axial coding was then used to connect the decision stages which emerged from open coding. The focus was on linking and interrelating each objective with the decision stages. The goals identified under any process may be multiple, intermediate, negative or positive. Finally selective coding was used to complete the systemic model.

Subsequently the coded data sheets were reviewed to assess the validity of the systemic model. The data sheets were checked independently by the

authors. Any outstanding or conflicting processes were also converted to objectives and goals in the systemic model (Ying Ying Liao et al, 2017)

The context of identification of goals and decision stages and finally mapping the same to selective coding items is explained below.

The process of identifying goals along with the context is embedded in information origination to counter uncertainties. Three categories of information to be originated in any problem situation, are (i) Problem Information, (ii) Problem Environment Information, and (iii) Alternatives Information (Khurana, Mandke, 2009)

4.0 Viewing Organization Systems as Information Systems through the lens of Systems Engineering

A generic business process a.k.a an organization covers the entire supply chain from concept to delivery. Business organizations have developed over a long period a variety of systems at different levels to provide for their survival in an increasingly complex economy. Input-plant-output model based systems represent traditional businesses, which emphasize individual production machines delivering standard engineering products. These models are characterized by plant operation level uncertainty because target (i.e., structured and periodic) values of all engineering product variables are subject to stochastic effects in the system components, which make up the product in the production process and in the environment in which the product is placed. These input, process-parametric, and output uncertainties (described as noise) contribute to system errors at the plant operation level.

In response to ensuing system complexity, business organizations have developed further systems at the plant operation level in the form of production systems, inventory systems, quality systems, accounting systems, and many others. Each of these functional systems plays an integral part in the planning, direction, and control of the organization. These systems, however, are interdependent; they must be coordinated and interrelated to achieve organization objectives. Thus modern business organizations are a system of systems and a candidate for the application of systems engineering techniques to study uncertainty implications for it (Khurana, Mandke, 2009).

In the given context, the focus will be on uncertainties arising due to the employment of the ASD workforce and the need to integrate them into the organizational systems. More so in the Indian scenario where autism as a disability was identified only in 2014 by the Indian legal system. Naturally, there will be uncertainties arising, first, for the employment of the workforce with ASD and, then, for sustaining and leveraging skills of such employees.

5.1 The need for Information origination due to uncertainties

i. Uncertainties in a business system comprising functional systems and physical variable controls

Either independently or collectively, functional systems generally display all the characteristics classically associated with a system, including input, process-parametric, and output uncertainties, as also uncertainties due to observation noise. These uncertainties affect system products by way of system errors of two types, namely, stochastic errors and functional errors.

(Khurana, Mandke,2009)).

ii. Uncertainty types newly emerged due to 'application' emphasis with system non-integration

With the advent of computer technology, the further impetus for system development has come in the form of input-plant/process-output models of business systems (comprising functional systems) incorporating higher-level process controls, namely, production control system, inventory control system and quality control system.

iii. The requirement to originate flexible information signifying the growing importance of information and risk from the origination of incorrect information

In other words, with increased emphasis on systems and with the increased use of information technology (IT), the business organization paradoxically finds itself increasingly operating in an environment of uncertainty, both within and beyond its boundary, and requires further smarter information and processes processing it, to make more precise estimates of the effects of these uncertainties. This is a requirement to originate information in the wake of environmental anomalies - a requirement to process unstructured and aperiodic, that is, non-repetitive, flexible information

(Khurana, Mandke, 2009).

iv. System failure from incorrect origination of information

System errors contribute to system failures. Taking together the system development perspective described above, at the primary level, the issue of system failure concerns mechanical failures, service disruptions, failure of computer hardware. At the secondary level, the issue is the failure of system equipment that is controlled directly by the computer ,at the third level also, it is the issue of system failure due to the production of incorrect (i.e., distorted) information. This brings in the questions of information types to be originated and uncertainties they remove, production of information and uncertainties therein, the concept of risk, value of information, and Information Integrity (I*I) (Khurana, Mandke, 2009).

5.2 Information types to be originated: Uncertainties they remove, Planning process they require

In the wake of environmental uncertainties, i.e., anomalies, the requirement is to originate information to make more precise estimates of the uncertainties and their effects; this is a process of cognizing the environment by leveraging mental processes of perception, memory, judgement and reasoning, as contrasted with emotional and volitional processes; it is a decision situation, and it involves information flow.

Goals play an important role in problem-solving. Information is originated to provide an expectation of an improved action. When formalized into goals, information originated plays an essential role in problem-solving, here in this case, by offering more precise estimates of uncertainties and their effects.

In case of creating a framework for employees with ASD, it is imperative for the organizations to identify the information components which will be applied for creating such a framework.

5.2.1 Three types of information

While dealing with the environment, three categories of information to be originated can be distinguished as relevant in any problem situation, namely, (i) Problem Information, (ii) Problem Environment Information, and (iii) Alternatives Information.

a. Problem information defines the problem. It clarifies or articulates the needs that must be met, the multiple objectives against which any alternative solution must be evaluated, and the relative priority of different needs and objectives. In the given context, the need is to integrate the autistic workforce into the organization. Cognizing the environment is a decision situation. For problem determination, two types of information are required, namely, factual information and normative information.

b. Problem environment information reveals the opportunities and constraints (for example, legal, technological, market, social, political) that open or restrict the range of possible solutions and the general environmental conditions, which will affect the contributions any potential solution will make to the various objectives. To be of any actual value, the two types of information; namely, opportunities and constraints, must be supplemented by a third kind, information about the alternative means of solving a problem, which indicates the nature-, characteristics-, and consequences-factors of the action or programs that can be implemented.

c. Alternatives Information:

Information about alternatives reduces uncertainty about the range of solutions to a problem and the consequences of implementing any course of action.

Thus, in the context of the hiring workforce with ASD, it is imperative to identify work areas for these people, characteristics of other opportunities that can be given to these people, and evaluating the contribution.

5.3 Intermediate Goals and Multiple Goals in removing uncertainties – A milestone wise approach to creating a smart system for hiring, retaining and leveraging the workforce with ASD.

The approach described above to deriving operable normative information accounts for intermediate and conflicting goals. It is common to define a problem-solving effort by a positive and/or a negative goal. These ambiguities, which contribute to uncertainties in problem information, can be got rid of by transforming negative goals into positive ones and then by breaking the positive goals at hand into intermediate goals, i.e., concrete, partial goals.

Also this gives rise to information on many factors and multiple goals, which are useful in reducing uncertainty. The requirement is to establish the operable goal statement (Khurana, Mandke, 2009).

5.4 Smart Systems making Responsible Decisions for its diversified workforce

It may be derived from the above aspects that in hiring people with ASD, it is essential to assign them goals; however, instead of assigning goals that are lofty and difficult to achieve and evaluate, they should be assigned intermediate goals. Efforts should be made to convert negative goals into positive goals, and conflicting goals should be treated as implicit goals.

The above analysis leads to a situation of many factors, multiple criteria situation for reducing the uncertainty of performance by ASD employees, and also a basis for formulating an operable goal statement.

Also, as discussed above, an organization may be mapped to an information system that will function as a smart system with continuous information origination and processing for flexible decision making in the context of the ASD workforce. Thus, an organization may function as a smart system capable of making responsible decisions for its diversified workforce, and the framework for the same is outlined below.

6.0 Information Origination Process Framework for a Smart System

The above desired framework brings forth the argument that Information Systems in order to maintain the currency of decision making in an uncertain environment need to cull out information continuously. Also, it is pertinent to state that smart systems can be termed smart if they can make flexible decisions in different situations. So in order to be termed smart, the smart systems need to continuously - interpret the context of the decision situation, understand the challenges in the evolving, interdependent, conflicting individual decision situation, identify the dynamic decision to be made,

cull out information items about the decision and make the decision (Kugel, 1988) (Khurana, Mandke, 2009)

6.1 Underlying Planning Process – Procedures, Four General Phases and Tasks

A business system unfolding with a requirement to have more precise estimates of effects of environmental uncertainties is a business system modeled as an open system and maximizing informational work for competitive and continuity planning advantage. Both aforementioned systems represent business Information System view by way of a closed-loop information and control system of which the business process is an integral part. In both cases, the requirement is to originate problem information, problem environment information, and alternatives information. The objective of originating this information is to select flexible information decisions as a solution to the environment-set problem due to uncertainty or to select flexible design information decisions to solve the design problem.

In any problem situation, control over the quantity of information available for a decision can be exercised through the choice of a planning process, which in actuality is represented by a smart information system(s), i.e., the set of procedures under which information is produced. By varying these procedures from the very intuitive to the very rigorous, alternative planning processes are obtained. Corresponding to the types of information needed for decision making, four general phases of an ideal planning process, each composed of different planning tasks, may be distinguished.

6.1.1 Four Phases- and therein Tasks-of the Planning process

Phase I of the planning process contributes to the identification of the problem. It has four tasks, namely, analysis of needs, determination of objectives, operational definition of objectives, and specification of standards and criteria. Analysis of needs and determination of objectives can be viewed as establishing, respectively, the factual and normative nature of the problem.

Phase II entails three activities of the planning process, which are necessary studies: resource potentials and needs, projections, and analytical models. These tasks identify various aspects of the problem environment. Necessary studies reveal natural and human resource quantities and qualities and identify other attributes of the problem environment, such as the values of critical environmental parameters. Projections specify levels of future needs primarily through the analysis of future demographic factors, rates of resource utilization, and related environmental factors affecting the success of the implemented solution and related environmental factors affecting the success of the implemented solution. The development of analytical models combines projections, parameter estimates, and other environmental studies into a coherent whole to design and evaluate alternative solutions.

Phase III of the planning process employs information developed in the preceding stages to define the range of attributes of appropriate alternatives (systems synthesis) and their consequences (systems assessment).

Finally, Phase IV of the planning process processes feedback information for feedback-review. Feedback review provides information about the results of completed activities at Phase III and the success of the implemented solution. Further, feedback information can be originated at the end of Phases I and II also.

6.1.2 Leading to A Smart System Process Framework: Planning Process as a Business Process IS View-A Continuous Individual Information Origination and Processing Situation a.k.a **Smart System**

Most information processing involves some type of data conversion to information in use, and, therefore, is closely related to a decision process with an objective. Even when the information is transmitted without changing form in a communication system, it is vital to decide the purpose of the transmission. Traditionally, a decision process (as under tightly coupled engineering systems or the business model seeking "standard" product in high volume) is a collective decision process and is viewed to comprise stages of forecasting, evaluation of already generated alternatives, and selection. However, the planning process for the production of information generates information and alternatives by comprising multiple decision stages (D0-D25). This, first, offers an analytical tool to account for differing system environments and dependency of the system on its internal and external environments. Second, it formalizes the importance of the environment as a significant factor in system decisions, which is critical to systems continuity planning in complex and changing environments.

Within the above framework, a planning process is a business process information system (IS), which – an individual decision situation *that it is* - is a continuous individual information origination situation. Building on sub-sections 5.1(iii) and (5.4), this view of the planning process then constitutes to be a Smart System, and, in turn, offers a general framework delineating the planning process phases in tandem with their respective decision-making stages; the same is shown in next section).

7.0 Differing Planning Phases - therein Decision-Making Stages Pairings and Their Information Requirements Example of Workforce Ecosystem Creation Management at Sharayu Precision and Associated Manufacturing Company, Chinchwad, Pune, India

i. **The planning process for production of problem information is detailed below**

1. Phase I (a): Analysis of needs,

Decision Stages (D0): Cost and benefits

To determine the cost of hiring an autistic employee and benefits of hiring him

2.Phase I (b): Determination of objectives

Decision Stages (D1- D7)

- D1- Based on long-term goal set, determining positive/negative goals, general/specific goals, clear goals, implicit goals.

- Long term goal of the employee – aid in improving the quality and quantity of the production to receive rewards in the organization.

- D2-Transforming negative goals into positive goals

- The employee with ASD may not be like other employees in behavior but may work with more sincerity and produce better output.

- D3-For positive goals identified, setting intermediate goals

- The long term positive goals identified in D1 above may be broken down into intermediate goals. The intermediate goals here will aid in improving the quality and quantity of the production, to be reviewed every quarter, and to receive the appropriate reward in the period.

- D4-For the problem-solving situation, identifying environmental anomalies or malfunctions that will emerge with delay

- When individuals with ASD are employed, there may be environmental anomalies in terms of settling down in the organization, interpersonal issues, work quality, and quantity deterioration.

- D5-Given the malfunctions that will come with a delay, determining what must remain unchanged, i.e., identifying environmental anomalies that must not occur in the process of problem-solving.

- Status of the employee and his targets should remain unchanged irrespective of the interpersonal issues, work quality and quantity deterioration over some time

- D6-Based on (D5), delineating multiple goals to make implicit problem-solving goals explicit

- For employees with ASD in order to achieve the quarterly target as defined in decision stage D3, it is imperative to identify multiple goals in order to make the target explicit. To achieve the quarterly target, it is essential to ascertain and state smaller multiple goals like reaching office/factory (place of work) at a specific time, delivery for a fixed number of hours, filling the hourly timesheet each day.

- D7-Based on Specific Goals (D1), (D3), (D5), and (D6), determining many factors and multiple criteria.

- This decision stage explicitly identifies many factors and multiple criteria required to meet the smaller multiple goals defined above, which will eventually lead to achieving the long term targets. These many factors, multiple criteria, will include the upkeep of the machinery and work premises, the health of the employees, conducive work environment, need-based training of the employees.

3.Phase - I (c): Operational definition of objectives,

Decision Stages (D8-D15):

- D8-Based on (D3), (D5), (D6), and (D7), determining independent goals

- The independent goal D8 will be defined as: The employee with ASD will contribute ‘x’ quantity of a ‘y’ quality to production every year in the factory/office (or designated workplace). The contribution will be evaluated quarterly. The employee will be expected to reach the place of work at particular time, every day delivery for a fixed number of hours, filling the hourly timesheet each day. In order to achieve the same updated machinery and work premises, maintaining the health of the employees, conducive work environment, and need-based training of the employees will be provided.

- ‘x’ and ‘y’ are variable which may be defined keeping in view the need of the organization.

- D9-Based on (D8), deciding delegation (contracting), identifying uncertainties in legated decision-making, and deciding operable goal statements.

- The operable goal statements which include the contracting and delegation will be defined as: in order to ensure that designated ‘x’ amount of product to be produced with ‘y’ amount of quality following aspects should be delegated (contracted)

  - Identification and statement of reporting time of the employee
  - Identification and statement of delivery hours by each employee
  - Designing and implementation of hourly timesheet
  - Updating and maintenance of machinery
  - Updating and maintenance of workplace
  - Maintaining the health of employees

- On-premise medical practitioners; clinic

- On-premise health check-ups
  - Providing training to employees
- On-premise training setup
  - Providing a conducive work environment for employees
- On-premise dining rooms
- On-premise entertainment areas
- On-premise gymnasium
- D10-Information about interdependent goals which are positively linked will be:

- The production will be aided by an employee with ASD by an amount ‘x’ with quality ‘y’

- This target will be achieved by positive practices in an organization like
  - Timely reporting
  - Following an hourly timesheet routine
  - Evaluating daily and quarterly targets

- The target will be aided by positive processes like
  - Updating and maintenance of machinery
  - Updating and maintenance of workplace
  - Maintaining the health of employees
  - On-premise medical practitioners; clinic
  - On-premise health check-ups

- Providing training to employees
  - On-premise training setup

- Providing a conducive work environment for employees
  - On-premise dining rooms
  - On-premise entertainment areas
  - On-premise gymnasium

- Based on (D10), selecting central goal from amongst positively linked goals and deciding operable goal statement for (D11).

- D11- In order to ensure production of quantity 'x' and quality 'y' it is critical to follow positive practices documented in D10

- Based on (D10), deciding the ranking of positively linked goals without time pressure and selecting operable goal statement (D12);

- Ranking of positively linked goals without time pressure D12:

- Priority 1: Updating and maintenance of machinery

- Priority 2: Updating and maintenance of workplace

- Priority 3: Maintaining the health of employees
  - On-premise medical practitioners; clinic
  - On-premise health check-ups

- Priority 4: Providing training to employees
  - On-premise training setup
  - Providing a conducive work environment for employees
- On-premise dining rooms
- On-premise entertainment areas
- On-premise gymnasium
- D12 -Based on (D10), deciding the ranking of positively linked goals with (or without) time pressure and selecting operable goal statement
- D13-Ranking of positively linked goals with (or without) time pressure D13:

- This target will be achieved by positive practices in an organization like
  - Timely reporting
  - Following an hourly timesheet routine
  - Evaluating daily and quarterly targets

- D14-Based on [(D3), (D5), (D6), and] (D7), determining information about interdependent goals, which are negatively linked (i. e, conflicting goals)

The conflicting goal D14 will be:

- The quality and quantity of production will improve as planned by employing people with ASD even though work environment-related issues emerge over some time.

- D15-Based on (D14), choosing, from conflicting goals with uncertainty, the operable goal statement, this will be

- Work environment should be maintained conducive in case employees with ASD are hired and have been assigned a target

4. Phase I (d): Specification of standards and criteria (such as time horizon, the relative weights to be accorded various objectives, acceptable levels of output, or system performance)

ii. Planning process for problem environment information is detailed below

1. Phase II (a)-Necessary studies: resource potential and needs,

Decision Stages (D16-D17):

- D16: From the operable goal statement identified in D15, the conduciveness of work environment includes:
  - Availability of updated machinery

- Availability of updated workplace
- Availability of following for maintaining the health of employees
- On-premise medical practitioners; clinic
- On-premise health check-ups
- Availability of following for providing training to employees
- On-premise training setup
- Providing a conducive work environment for employees
- On-premise dining rooms
- On-premise entertainment areas
- On-premise gymnasium

Note: While operable opportunity space may be defined with the help of "formally stated rules" and "statements of limits," operable constraints can be stated in terms of "defined sanctions" and "credible threat of loss/inconvenience/punishment."

- D17 Useful information variables culled out from ‘many factors’ characterizing problem complexity

- Machinery availability
- Upkeep of machinery
- Work premises availability
- Upkeep of work premises
- Health of employees
- Work environment
- Training facilities

2. Phase II (b)-Projections primarily through the analysis of future demographic factors, rates of resource utilization, and related environmental factors affecting the success of the implemented solution.

Decision Stages (D18)

D18-Recognizing relationships (interdependencies) between culled out information variables

- All the information variables culled out in D17, when maintained or improved upon, will lead to the positive impact on the target of production 'x' with a quality 'y,' identified for the employee with ASD.

Also:

- Higher machinery availability will lead to more requirements for upkeep of machinery
- Higher machinery availability will lead to more requirements for suited work premises
- More sophisticated (suited) work premises will lead to more requirements for upkeep of work premises
- The health of employees will depend on the facilities in work premise for health checkup and maintenance
- Proper training facilities, health upkeep facilities, and work premises lead to a pleasant work environment, which will eventually help in employees with ASD to meet their targets.

3.Phase II (c)-Analytical model

Decision Stages (D19)-Developing state transition model defining dynamic behavior of culled out state (information) variables (D19)

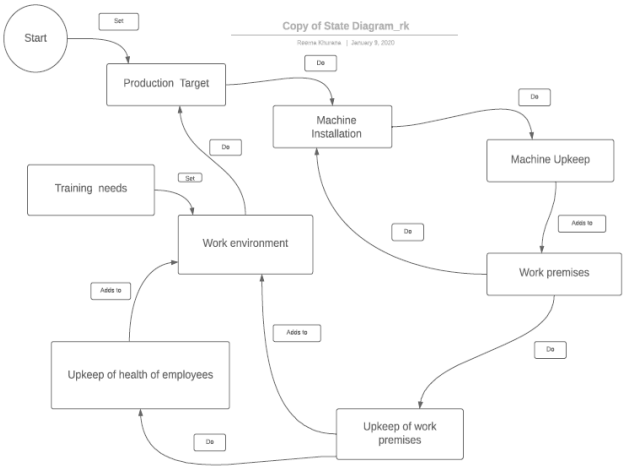

Fig 1.0: State transition model defining dynamic behavior of culled out state (information) variables for decision stage D19

iii. **The planning process for the production of alternatives information, for their evaluation, for selection of flexible information decision, and its consequence information**

1.Phase III (a)-Systems synthesis

Decision Stages (D20-D22)-Within the framework of opportunity and constraints’ spaces (D16) and based on the state transition model (D19), undertaking customized planning & design (i.e., unstructured and aperiodic processing of factual information continuously obtained on current basis for the problem at hand for generating alternatives for evaluation

- D20- Plan for the continuous process of :

- Machinery installation
- Machinery upkeep
- Work premises
- Upkeep of premises
- Upkeep of health of employees
- Better work environment
- Training of employees

- D21- Each of the parameters identified at D20 will be instrumental in contributing to the operable

goal. Selecting flexible information decision for control implementation at D22.

- D22- All the parameters in D20 will be selected for flexible information decisions, as the requirements will change for each of them, and continuous information origination needs to be done to achieve the operable goal.

2.Phase III (b)-Systems assessment

Decision Stages (D23-D24):

-Processing of information decision (D22) by process controls ("applications") and physical variable controls at physical control system for decision stage D23.

- D23- Controls identified for each parameter

Sno.	Parameter	Controls and time for originating information for the control to be applied
1.	Machinery installation	Check on machinery in terms of units deployed and quality, status to be updated each quarter
2.	Machinery upkeep	Maintain the logbook of preventive and corrective action, status to be updated each day
3.	Work premises	Check on work premises as per norms, status to be updated bi-annually
4.	Upkeep of premises	Maintain the logbook of preventive and corrective action, status to be updated each day
5.	Upkeep of health of employees	An equipped clinic on-premise as per norms, status to be updated bi-annually
6.	Better work environment	Feedback form to be designed and the same should be filled by employees, status to be updated monthly
7.	Training of employees	Requirement form to be designed and the same should be filled by employees/supervisors, status to be updated quarterly

As per control inputs from (D23), processing business inputs through the business process to deliver product/system/service (information product inclusive) to the recipient (customer) as per requirements for the decision stage D24.

- D24-There will be two recipients; one is the employee with ASD, and the other is the consumer of the product manufactured by the organization.

iv. **The planning process for the production of feedback information for feedback review**

Phase IV: Decision Stage (D25): -Within the framework of (D24), obtaining and processing feedback, and reevaluation raw data/information for Stage I (D25).

- D25 -Feedback form will be designed for both the consumers and the system should be able to absorb the feedback and move forward

The above completes the study of Sharayu Precision and AMC as a differing planning phases comprising planning process, which is a business process information system (IS) and (which) is an individual decision situation in the fold of a continuous individual information origination.

8.0 Conclusion

The framework presented above has laid out a framework to originate and process information for smart and responsible decision-making. It has been validated and verified by applying to a workforce management company called Sharayu Precision and AMC in Chinchwad, Pune, India.

In context of Sharayu Precision and AMC each of the informational entities created above, the variables culled out and originated at the decision stage D0-D25 are informational elements, which need to be continuously originated for the smart system to be able to make decisions to deliver performance desired.

Specifically, the paper has used a systems engineering perspective to view Information Systems as the basis of business systems. The paper has extended the application of Information Systems to Smart Systems by suggesting a framework of continuous information origination and usage. Ethnographic qualitative research methodology has been used as a precursor to systems engineering based information processing approach to cull out parameters for responsible decision making by smart systems in a manufacturing environment. The workforce-ecosystem-management-performance desired research examples Sharayu Precision and AMC. A framework is developed to create a smart system – as a system of systems - to aid the engaged business organization in making decisions by originating information to counter the uncertainties in hiring and sustaining employees with ASD with a view to leverage *this* high business value creating (but otherwise traditionally underutilized and neglected) human resource for improving the efficiency as well as effectiveness of the organization. The smart system framework presented is business domain agnostic; it can be used by the organization in different domains and different levels to counter complexities and uncertainties in decision-making.

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