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Validation of Deursen's Internet of Things skills (IoTs) : Indian gen Z assessment

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Abstract

The Internet of Things and respective skilling is a matter of extensive research. The individuals possessing such skills have paramount advantage over the ones not possessing such skills. Especially in Indian technological landscape, the digital skills and digital inclusion tendencies are gradually transforming yet have not developed to the fullest. The youth foresee immense potential in learning and unlearning the IoT skills and characteristics. The study hence based on validation assessment of Deursen's Internet of Things skills (IoTs) across Indian generation Z will provide insights into the mechanics and dynamics of perceptions with regard to skill-based prowess. The study leverages two types of skills-related to strategic IoT and operations & data analysis in order to ascertain the skill-based dexterity of the youth. The study relies on CFA and SEM modelling to ascertain the impact. The results and findings of the study will give an important insight into their current IoTs skills, areas where they need to improve or wider impacts on education, policy and industry in India. The findings of the study confirm that there are important differences between women and men in terms of their level of education, as well as among students with different levels of knowledge. The results have shown that, as regards shaping the employability discourse, there is support for Internet of Things skills and differences in them.

These findings can help stakeholders better prepare the younger generation for the IoT-driven future.

Subject Classification: *68M11 Internet topics.*

Keywords: *Internet of Things skills (IoTs), Digital inclusion, Strategic IoT skills, Data IoT skills, Operational IoT skills.*

1. Introduction

The 'Internet of Things' skills and verbology refers to a defined ecosystem that integrates every internet connected object, device or equipment, consumer durable or smart watch and computing device with aid of sensing, information sharing or code sharing across Wi-Fi or other network architectures. The smart watch as controlling the refrigerator temperature, Alexa and other audio driven control mechanism and entertainment means; all identify as crucial elements of Internet of Things

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mechanisms that we use in daily lifestyle. It helps in enhancing the decision-making skills and improved business processes [11]. IoT in fact relies on the internet as basis for connecting and establishing linkages across physical devices located across distance from each other. The Internet as a medium for connecting physical devices enables cross-device communications and lays the foundation for an omnipresent and networked system that entails focus on cross device flow of information and encryptions. The data security Is however an issue that is worth considering in such aspects. Anyhow, the potential impact of IoT on customer's citizen's and layman's life are immense and complex. The whole offering of products and services over the digitally transformed economies has undergone change and IoT has enabled the transformation in the manner in which services are being delivered, product based add on value is being created and manner in which value addition is being undertaken. [14] Despite these evolving advantages of IoT in daily life and lifestyle enhancement, the involvement and engagement of masses and common man in Indian perspective is still a miss. The research on personal motivations to adopt technology, to learn new skills and unlearn previous baggage and knowledge regarding optimal and appropriate usage of IoT is still dismal in Indian perspective. The skilling of masses with regard to IoT usage and efficiency management is not up to mark. As per studies in Indian perspective, the technology diffusion and technology acceptance are growing at gradual pace and Indian digital skills inventory needs to be worked upon in order to meet global productivity standards. Though the usage of technology and human computer interactions are rising yet the ability of common men in India to tap and benefit from IoT seems distant. The underlying reason is the lower levels of digital skills especially the awareness and knowledge regarding the IoT operationalization in daily life. The technology and respective skills will call for research attention unless and until people leverage technology in their daily life for solving some of the problems they are facing. Technology skills identify as one of the most researched aspects yet non convergent research exists regarding eh specific IoT skills to be developed and harnessed by masses in order to benefit from the IoT impetus. Especially in this age of Digital India and extensive digitalization, IoT skills carry immense weightage in order to accomplish day to day activities with active technology intervention and with lesser stress and strain. Despite the rising relevance of IoT skills, the research on subject tis still in its infancy and India specific operationalization of skill-based development is deemed essential. The rationale behind this research is to reflect upon the skills in preview of IoT that has to be

harnessed in Indian students, which could have significant repercussions on sustainable employability and in turn enhance our understanding of IoT skill matrices.

Problem Statement

The purpose of the research is bilateral. To validate and test a reliable measure of IoT skills in Indian perspective and to present implications and findings that can shape Indian student's sustainable employability in internet and information age. In order to accomplish these research objectives, the literature will be reviewed and conceptual framework for India specific IoT skills will be developed and globally accepted Deursen's Internet of Things skills (IoTs) will be tested for reliability across Indian students and their yearning for sustainable employability [4]. The existing measures for instrumentation of IoT skills seem to be biased towards the focus on mere device usage or smart gear usage. Much of the review on the issue of the non-satisfactory state of skill measurement across Indian students in final years of institutions, has been based on the previous studies on the earlier technology skills and outdated technologies [3]. In fact, a larger section of our preliminary knowledge regarding the student's plight is based on the findings of report of the NASCOM and other organizations in India. In absence of adequate and comprehensive literature on the subject matter, literature from diverse disciplines, psychological theoretical frameworks, gender specific studies and the human capital management literature was leveraged for the interpretation of the study in context of developing economy. The previous researches point towards a role of knowledge levels in shaping this psychological construct. The social cognitive roots of the factor lead to the diverse portfolio of scale to measure the student's IoT specific skilling and versatility [9].

Literature on career sustainability with IoT skills

In one of the researches based on diverse contexts in an onion-skin model, four levels were identified namely students, the work undertaken, society at large and the culture surrounding them [12]. The career sustainability has long remained a matter of extensive analysis of research which is function of skilling, learning and consistent re-skilling. IoT skills like other ICT skills [1] have the potential to replace the jobs yet student's versatility in technology and differential ability to contribute to

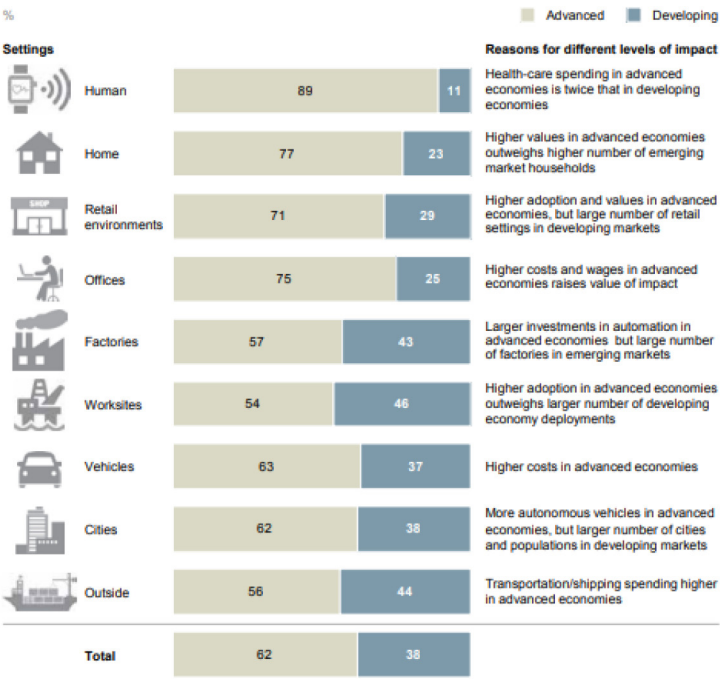

Figure 1

IoT deployment in advanced and developing economies.

Source: (Maniyka, Chui, & Bisson [10])

organizational productivity matters in manifold ways. The literature [8] on subject identifies the matter undertaking the factors of sustainability, consistent skilling and industry wide technology evolution. A study by McKinsey [10] revealed the usage and deployment potential of IoT in advanced and developing countries worldwide (Figure 1). The study figured out that India and other developing countries foresee maximum industrial and supply chain deployment and hence the scope for more employability and jobs.

Exploring employability with IoTs Skills

Employability skills have been widely interpreted as those individual specific internally harnessed 'intrinsic personal capabilities' that could foster in individual student the ability to contribute extensively to self-realization in employer's perspective. Yet the skill content amidst recent

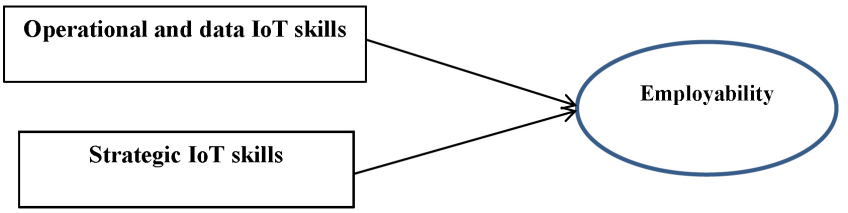

Figure 2

Research Model and Hypothesis

Source : Author`s self creation

technological changes is a worrisome aspect [2]. The evolving digital divide [13] however presents a challenge as well as an opportunity in terms of skilling perspective. The challenges to sustainable employability and rising scope for business-oriented skilling [7] are immense yet the pro- employment skilling is essential for the future employability and IoT skilling is one of the greenfield areas [6]. In his work, Islam [15] aims to ascertain whether students are prepared for the cutthroat labor market of today. Above all, it is important that they possess the necessary skill set to seize the opportunity.

H1: There is significant impact of 'Operational and data IoT skills' on student's 'employability' prospects (Figure 2).

H2: There is significant impact of 'Strategic IoT skills' on student's 'employability' prospects (Figure 2).

Methodology

This research has undertaken both primary and secondary data is used to validate and test a reliable measure of IoT skills in from an Indian perspective and to infer the results and present findings and recommendations that can shape Indian student's sustainable employability in the age of internet and information. The data was collected from 250 college students in their second or third year who were enrolled on management or technology-based programs. The studies on subject categorically differ with regard to choice of target population for the factor operationalization. There seems to be two distinct set of target population as identified in literature. One set of literature relies more on student as possible target population for the study yet another set

emphasizes more on the corporate human resource managers as most appropriate choice for research. The literature on choice of 'students' as 'target population' for the purpose of research; reflects tremendously on the positive aspects. The possible merits exemplify in form of interpreting the ideas and viewpoints of the people who actually decide the employability in organizational perspective. The foremost merit is in form of the advancing our knowledge about the aspects that matter across decision makers. The sample frame comprises the India based final year students who are actual decision makers in employability flora. The research deployed random sampling for the individual student selection. The selective tests for scale refinement and validation were done. The KMO Test, EFA, Cronbach Alpha, Correlation Assessment, CFA and SEM were used. In order to investigate the representing dimensions of the components that were considered for the analysis, the study made use of the factor analysis approach. With regard to the data gathered from the questionnaire using a Likert scale, the extractive factor analysis leads to an assessment of the dimensional validity and makes the evaluation of the dimensions easier. The AMOS version release 22.0 was harnessed to accomplish the evaluation of structural relationships between the relevant factors. The review of literature depicts the requirement for segregating the loading and non-loading items to confirm the empirical validity of the factors.

Measure: Deursen's Internet of Things skills (IoTs)

Operational IoT Skills identify as the skills constituting the focus on setting up smart devices, using and leveraging smart devices in day to day working and organizational matters. The skills are fundamental to internet and smart device usage as without them the internet usage is unfeasible. The skills identify as building blocks of employability and information engineering while working in IoT enabled work places.

Strategic IoT Skills on the other hand constitute focus on strategic and selective skills being leveraged by incumbent student for achieving a particular goal at work place. In order to benefit from installed and desired IoT system devices, such skills are desired to be operationalized at work place.

Table 1
Constructs and Sub Scale Items

Constructs	Sub Scale Items	Source
Operational and data IoT skills	I know how to set up smart devices for different users	(Deursen, Zeeuw, & Jansen, [5])
	I know how to reset smart devices to the original settings	
	I know how to connect smart devices to my network	
	I know how to view data my smart device collected	
	I know how to check if the collected data from my smart device is correct	
	I know how to display data from my smart device in a chart	
	I know how to compare data from my smart device to data other users collected	
	I know how to adjust the privacy settings of my smart device	
Strategic IoT skills	I know how to achieve my intended goals with my smart devices	
	I know what actions to take based on data from my smart device	
	I know how to see if I am making progress with my smart devices	
	I know when to adjust my smart device to achieve my goal	
	I know how to make better decisions with my smart device (e.g., about energy or health)	
	I know how I perform best with my smart device	

Source: Author`s Self Creation

Analysis

As per the standard practices, it is essential to carry out a reliability assessment in order to assess the homogeneity of responses obtained from likert scaling instruments (Table 1). In order to determine the nature of responses received, it is deemed necessary to have reliable data. The

literature currently shows that in order to verify the reliability of data based on their Internal Consistency, it is necessary to conduct an analysis of accuracy. In the range of 0.7 to 0.9, it was observed to be of significantly relevant. As revealed in the KMO tests, communality assessment and pattern analysis, the loading sub-scale items were further validated with CFA covariance analysis (illustrated in Table 2).This shows that data factorability is prominent from across the data hence collected (Table 3).

Table 2

KMO assessment

KMO and Bartlett's Test		
Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		.891
Bartlett's Test of Sphericity	Approx. Chi-Square	8710.648
	df	55
	Sig.	.000

Table 3

Communalities assessment

Communalities		
	Initial	**Extraction**
ODS1	1.000	.830
ODS2	1.000	.778
ODS3	1.000	.800
ODS4	1.000	.855
ODS5	1.000	.828
ODS7	1.000	.872
STS2	1.000	.898
STS3	1.000	.899
STS4	1.000	.854
STS5	1.000	.839
STS6	1.000	.882
Extraction Method: Principal Component Analysis.		

Table 4

Variance assessment and factor extraction

Total Variance Explained									
Component	Initial Eigenvalues			Extraction Sums of Squared Loadings			Rotation Sums of Squared Loadings		
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1=ODS	6.119	55.623	55.623	6.119	55.623	55.623	4.948	44.980	44.980
2=STS	3.216	29.241	84.864	3.216	29.241	84.864	4.387	39.884	84.864
Extraction Method: Principal Component Analysis.									

The Table 4 portrays the variance exhibited by the constituent factors. The factor one exhibited 55.6 percent variance and factor to demonstrated 29.2 per cent variance.

Table 5

Dimensional pattern matrix

Rotated Component Matrix[a]		
	Component	
	1	2
ODS1	.899	
ODS2	.870	
ODS3	.886	
ODS4	.914	
ODS5	.896	
ODS7	.923	
STS2		.936
STS3		.940
STS4		.912
STS5		.902
STS6		.929
Extraction Method: Principal Component Analysis. Rotation Method: Varimax with Kaiser Normalization.		
a. Rotation converged in 3 iterations.		

The Table 5 illustrates the loading sub scale items for the factors concerned across the extractive factor analysis.

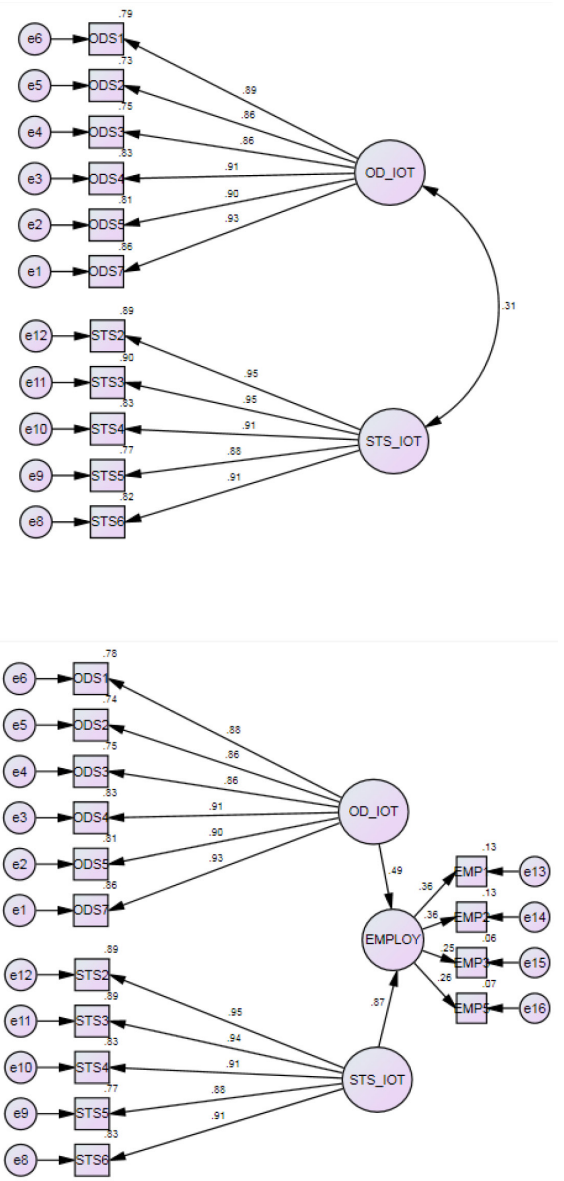

Figure 3

Regression weights

Standardized Regression Weights: (Group number 1 - Default model)

			Estimate
EMPLOY	<---	OD_IOT	.491
EMPLOY	<---	STS_IOT	.871
ODS7	<---	OD_IOT	.925
ODS5	<---	OD_IOT	.898
ODS4	<---	OD_IOT	.910
ODS3	<---	OD_IOT	.865
ODS2	<---	OD_IOT	.857
ODS1	<---	OD_IOT	.885
STS6	<---	STS_IOT	.909
STS5	<---	STS_IOT	.877
STS4	<---	STS_IOT	.910
STS3	<---	STS_IOT	.944
STS2	<---	STS_IOT	.946
EMP1	<---	EMPLOY	.357
EMP2	<---	EMPLOY	.364
EMP3	<---	EMPLOY	.248
EMP5	<---	EMPLOY	.261

Outcomes

The study vindicated significant differences across gender, across the student's intellectual levels as well as across the streams of education (Figure 3). The results vindicated support for IoT skills and inherent differences as shaping the employability discourses.

H	Hypothesis statement	W	Outcome
H1:	There is significant impact of 'Operational and data IoT skills' on student's 'employability' prospects	.491	Supported as path weight >0.1
H2:	There is significant impact of 'Strategic IoT skills' on student's 'employability' prospects'	.871	Supported as path weight >0.1

Implications

The research findings possess meaningful and practical theoretical implications for further research on subject matter. The theoretical

interpretation of 'influences' on fresh management graduate's dynamic employability and resultant employer satisfaction received adequate research focus. The theoretical implications of research; seem to revolve around the 'resource' paradigm' and 'dynamic' capabilities' approaches. The human capital notions and intellectual capital offshoots are prevalent. The 'knowledge' and skilling' perspective and 'knowledge management' notions seem vibrant. The different person or individual centric perspectives 'resource' paradigm', 'dynamic' capabilities', 'human capital' and 'knowledge management' seem to play a vital role in shaping incumbent's employability in organizational contexts. The research outcomes vindicate the individual's own critical position in shaping the scope for employability and organizational utility in terms of transferable skills and competencies. The research outcomes vindicate the earlier studies that call for individual graduate as a prominent proximal determinant of employability in capitalistic world. The theoretical implications hence focus on the evolving role of individual self-driven inclination for skilling, re-skilling (in wake of ongoing epidemics) and undertaking measures to ensure value of human capital and their continuous learning. The theoretical implications are institutional and structural relationships emerging from the range of outcomes. Implications of the research is useful for Stakeholders such as individuals or groups that have an interest or influence in the IoT project, such as customers, suppliers, vendors, competitors, managers etc. Users are the individuals who directly interact or come in contact with the IoT devices or services, such as citizens, employees or consumers.

The theoretical implications hence focus on the probability of individual role, state's role, society's stimulus and organizational bodies in shaping employability.

Limitations

The limitations of current academic research revolve around the choice of factors, the selection of research tools, sample size as well as the manner of factor operationalization. The study based choice of factors (though supported by literature) could be a limitation as new literature could lead to selection of new contextual and immediate aspects as shaping graduate's propensity to act in a particular manner. The factor operationalization methodology could come under question as each factor was worked out with aid of pre validated scales. On a single factor as considered in this research, there could exist multiple measurement

instruments. Hence the choice of a particular sub scale item over other or even the difference in economic conditions in India and Europe could figure as prominent limitation. The study setting for the current academic research comprises the final year degree or course enrolled students who are not apt at judging and evaluating the new skills and their marketability and are responsible for forecasting the human resource sustenance patterns. This in turn could act as limitation as experienced and field personals were excluded from research process.

Directions for future research

The further research can be carried out across the areas of final year management graduates who are in phase of probation and across the graduates (or new employees) who have completed one year of permanent employment in a role or position across organizational hierarchy. This could help us explore and interpret the differences in perceptions over period of time. The further research could be conducted across areas of contextual and environmental influences on structuring the sustainable employability in Indian context in post COVID phase of recruitment. The further research areas could be the changes in employee and employer opinions across phases of time as per changes in technology, curriculum, industrial skill requirements and possible need for product and process innovation. The future areas of research include leveraging the potential of fresh management post graduates in harnessing organizational competitiveness and sustainable reach to markets. The research can be carried out in longitudinal nature over a period of say ten to twelve years to establish the mobility of influences.

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