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Analyzing Industrial Intranet Technology Effect on the Performance of Oil and Gas Companies in Nigeria

P.Kamala kannan[1]

[1]University of Liverpool
[1] kannanyouva121@gmail.com

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Abstract

Industrial intranet connects the entire industrial assets of the organisation to a specific internal network. The network can permit only specific persons to access them. This in turn restrict the company's industrial assets data to be available on the internet. Oil and gas industry is a highly complex business environments and companies forced the employees to make fast and effective decision with regard to industrial assets. With the help of industrial intranet, oil and gas companies can access the industrial assets information in a speedy way. Besides, efficient storage of information, interactive collaboration and technical compatibility. Above stated attributes exhibits in industrial intranet have influenced the companies to utilize it to overcome constraints like redundant information or unnecessary duplication, disorganized documents, obsolete information, and decaying links. In addition, it offers not only information on how to complete the processes on time but also tools and services required to accomplish the task on time. Therefore, industrial intranet become strategic business tools for oil and gas companies in Nigeria. The present aims is to investigate the impact of industrial intranet using task technology fit elements within oil and gas companies in Nigeria and to develop a framework for effective utilization of industrial intranet for the organization. The findings would insights on how industrial intranet could improve the individual performance of oil and gas companies in Nigeria.

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I. INTRODUCTION

Technology plays a crucial role in assisting and facilitating the work processes especially in oil and gas industry . The utilization of technologies assist the companies in investigating large quantity of structured and unstructured data from various sources and generate it as a real time insights. Nowadays, oil and gas companies faces complex in accessing huge volume of data. Emergence of technology paves the way for the companies to create an impact especially in terms of new level of connected intelligence to oil and gas operations. As per the survey made by Accenture, big data analytics, industrial intranet and mobile devices occupying as a top digital investments for oil and gas companies.

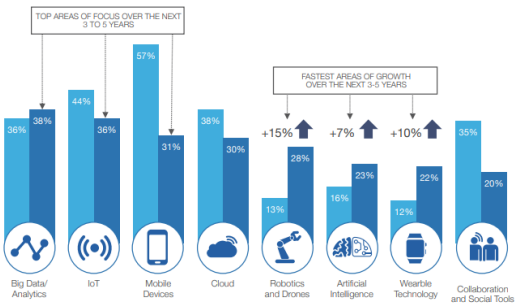

Fig 1: Digital investments

Hence, the above stated new technological advancements forced the oil and gas companies to make an important changes in operations to make it more viable in the low price environment. (williams, 2019)Oil and gas industry pioneered with new models, digital investments and compliance

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solutions which makes the industry to be turnaround in the recent days (Halvorsen, 2018). Cheap sensors, widening connectivity and ever greater computing power is already ruining the industry. Modern offshore drilling platforms already have nearly eighty thousand sensors for predicting 15 petabytes of data during an assets life time . Hence increasing assets utilization is a critical area while developing the oil and gas industry. Therefore it is vital to improve the utilization rates which in turn provides a prospects to lower the costs and drive the efficiency of the sector. Oil and gas companies prefers industrial intranet is to upsurge the production in the oil field, stimulate the throughput in the refinery and upsurge asset utilization is a foremost goal for the technology investment in oil and gas industry. Besides, the companies make an investment in industrial intranet of things to inform an impactful decision on real time assets information. This is primarily because of eradicate the complexities involved in connecting every continent and time zone around the world. Therefore, oil and gas companies connect their field assets and equipment with industrial intranet i.e one common corporate intranet using sensors which provides an automated monitoring and diagnostics to the concerned department. This in turn makes the environment to gain connectivity using industrial intranet, simplify the entire supply chain which creates an impact on individual side. Hence the study, makes an effort to make a probe on how industrial intranet ruined the oil and gas companies, fostering the employee opinions on accepting the technology using task and technology fit theory.

II. OBJECTIVES OF THE STUDY

The objective of the study is to explore the opinions of the employees with regard to the acceptance of technology adopted for monitoring industrial assets in Nigeria

III. THEORETICAL FRAMEWORK

The present study incorporates task technology fit theory, which is an expansion of information system success model of Delone and Mclean (1992). The model developed by Delone and Mclean (1992) pointed out the most significance of task technology fit in improving the performance of the organization. Goodhue & Thompson, 1995 stated that the performance outcome primarily dependent on how level of fit exists among information system and tasks to be performed. He framed a model which exhibited in the below diagram.

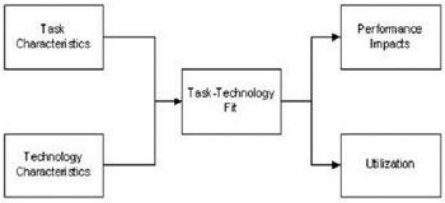

Fig 2: Task and technology fit theory

The primary application of adopting the theory is stating that a high technology fit results better performance for the organization. The first and foremost dimension in the theory is the fit among technology and task attributes. Task technology fit referred as the ability of an information provider to assist task matching technology capabilities in accomplishing task demands . With the help of theory, it is perceived that new technology likely to have a positive influence on individual performance. If it uses continuously, then it matches the task that the user perform. Goodhue and Thompson (1995) developed a measure which has eight attributes. Quality, locatability, authorization, compatibility, training, production timeliness, system reliability and relationship with the users. Hence the researcher applied the original task technology fit theory to identify the impact of technology in oil and gas companies in Nigeria.

Task characteristics

It refers to the individual activities in transforming the inputs into outputs. The primary intention is to

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satisfy the users with their information needs. (Goodhue, 1995). The present study consider the task attributes using sensors and actuators. Though there are various dimensions like task non routines, task interdependence, time criticality, the researcher applies task equivocality and task interdependence (Goodhue, 1995) because the aspects of monitoring achieved using technologies are the task characteristics for the study.

Technology characteristics

Goodhue (1995) defined technology as the tool that is either hardware or software used by individuals in carrying out their tasks. The aspects of technology tools may influence technology utilization and users' perceptions (Goodhue, 1995, 1998). The task-technology fit model considers the importance of fitting the functionality and attributes of technology used to the demands imposed by individual needs

Task and technology fit

It is defined as for an information technology, how IT have an impact on individual performance and how the technology utilized and the extent to which the technology must be a fit with the task it assists. As per Goodhue(1993), the researcher investigate the sensors and actuators of industrial intranet within the user task domain of IT supported decision making. The researcher considered the eight appropriate dimensions like quality, locatability, authorization, compatibility, ease of use, production timeliness, system reliability and relationship with the users. Goodhue (1993)

Performance impact

It refers to how an individual belief about their task execution capabilities and how it changes after using smart sensors and actuators interventions. High task technology fit has an impact on individual performance (Goodhue, 1995).

IV. CONCEPTUAL FRAMEWORK

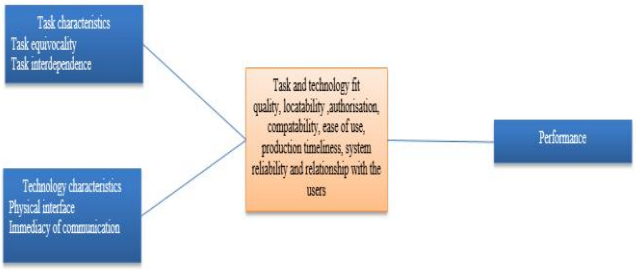

Fig 3: Conceptual framework

V. RESEARCH METHODOLOGY

Research methods represented to the extent that comprehending research issues for the better understanding of research outcome. To investigate the research issues, the researcher considers the sampling frame to be the organization who applies industrial intranet in Nigeria. The top level managers selected because they have the power to influence the technology to gain competitive advantage in the market . Hence identification of top level managers based on criteria set forth by (Badpa et al 2018) The targeted population to be managers attached to maintenance department who are monitoring industrial assets through intranet. About 50 self-reporting questionnaires sent to HR departments of the respective organization and only 35 sent back. Hence the response rate to be 70% which is noticeably high and the representative of population studied enables generalization of results to be obtained .

VI. ANALYSIS

The section exhibits the demographic profile and attributes of industrial intranet uses in the oil and gas companies in Nigeria.

Particulars	Frequency	Percent
Age		
25 years and above	11	31.4
26 to 35 years	7	20.0
36 to 45 years	7	20.0
Above 45 years	10	28.6
Gender		
Male	35	100
Female	0	0

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Education qualification		
Bachelor degree	10	28.6
Masters degree	14	40.0
Doctoral degree	11	31.4

It is observed from the table that 31.4% of respondents belong to the age category while an identical 20% of respondents between the age category of 26-35 years of age and 36-45 years of age and 28.6% of are above 45 years of age. With regard to gender, 100% of respondents are male. Concerning education qualification, 28.6% of having a bachelors degree, 40% of having masters degree and 31.4% of having doctoral degree.

Kind of industrial intranet having in organization

Particulars	Frequency	Percent
One common corporate intranet	**16**	**45.7**
Location based versions	**11**	**31.4**
Different intranet for different units	**8**	**22.9**
Total	**35**	**100.0**

It is observed from the table that 16 respondents stating 45.7% of using one common corporate intranet while 11 respondents stating 31.4% of using location based versions and 8 respondents stating 22.9% of using different intranet for different units.

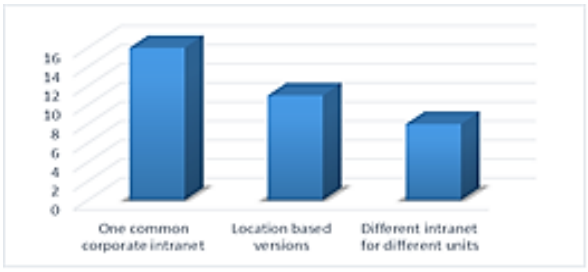

Fig 4: kind of industrial intranet having in organization

What type of contents does your industrial intranet offer it to users

Particulars	Frequency	Percent
Industrial assets information	8	22.9
Internal company news	4	11.4
Work instructions, guidelines and process descriptions	8	22.9
Interactive sessions	4	11.4
Links	7	20.0
others	4	11.4
Total	**35**	**100.0**

It is clear that 8 respondents stating 22.9% of stating industrial intranet offers industrial assets information to the users, 4 respondents stating 11.4% of providing internal company news to the users, 8 respondents stating 22.9% of providing work instructions, guidelines, process development to the users, 4 respondents stating 11.4% of providing interactive sessions and other information to the users and 7 respondents stating 20% of offering substantial link to the users.

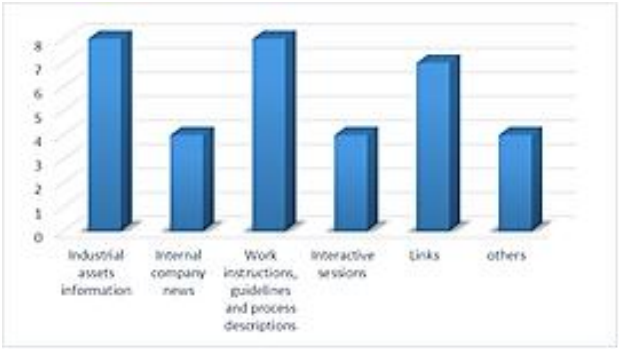

Fig 5: type of contents does your industrial intranet offer it to users

News Information Published On the Industrial Intranet

Particulars	Frequency	Percent
Many times a day	11	31.5
Daily	10	28.5
Weekly	9	25.7
Less frequently	5	14.3
I don't know	0	0
Total	**35**	**100.0**

It is observed from the table that 11 respondents stating that 3.5% of getting information many times a day while 10 respondents stating that 28.5% of getting it daily, 9 respondents stating that 25.7% of weekly and 5 respondents stating that they are getting less frequently.

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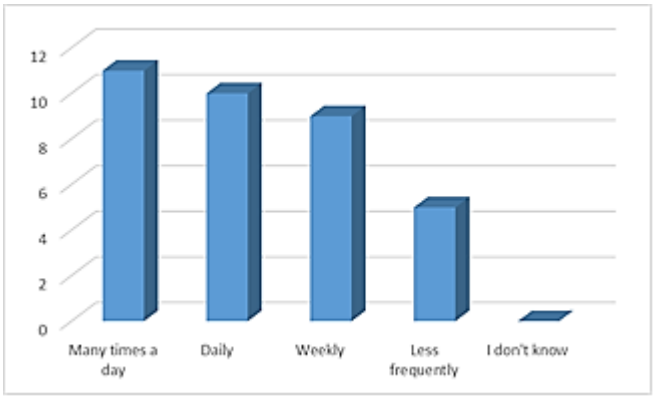


Fig 6: news information published on the industrial intranet

Kind of sources of information getting for monitoring industrial assets

Particulars	Frequency	Percent
Emails	10	28.6
Weekly summaries of industrial assets	8	22.9
Team meetings	8	22.9
Forums	5	14.3
Others	4	11.4
Total	**35**	**100.0**

It is observed from the table that 10 respondents stating 28.6% of getting emails, an identical 8 respondents stating 22.9% of getting weekly summaries and through team meetings. Respondents of 5 members stating that 14.3% of through forums and 4 respondents stating that 11.4% of through others.

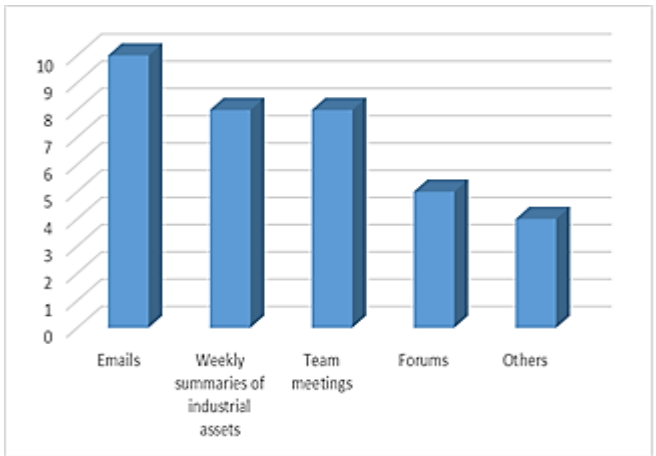


Fig 7: kind of sources of information getting for monitoring industrial assets

How important industrial intranet for monitoring industrial assets of oil and gas companies in Nigeria

Particulars	Frequency	Percent
Highly important	11	31.4
Important	8	22.9
Neutral	10	28.5
Unimportant	3	8.6
Highly unimportant	3	8.6
Total	**35**	**100**

It makes clear that 11 respondents stating 31.4% of stating industrial intranet is highly important while 8 respondents making 22.9% of stating it as important, 10 respondents making 28.5% of stating it as neutral and an identical 3 respondents making 8.6% of stating it as unimportant and highly unimportant.

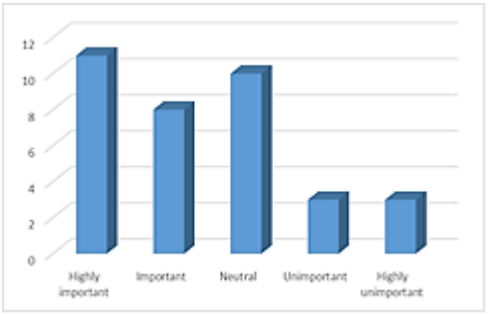
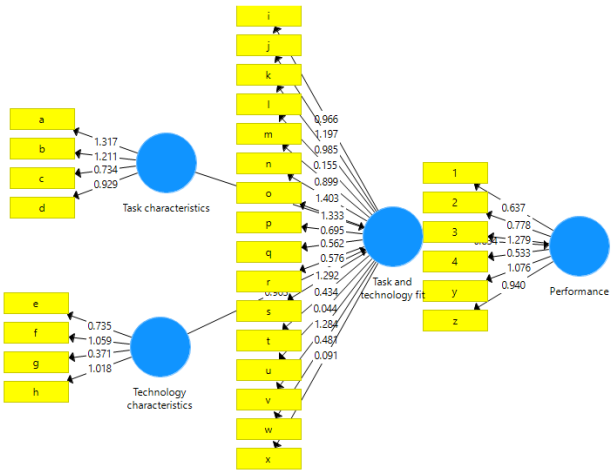


Fig 8: Important of industrial intranet for monitoring industrial assets

PLS-SEM



Evaluation of outer measurement model

The primary intention of assessing the model is to calculate the reliability followed by internal

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consistency and validity of the observed variable with the unpobservedone . The present study evaluate the consistency using construct reliability test whereas convergent for assessing the validity. The study investigates the outer loadings and the values are higher than 0.7 and hence it found to be acceptable whereas lesser than 0.7 found to be discarded

Construct reliability and validity

Particulars	Cronbach's Alpha	Composite Reliability	Average Variance Extracted
Performance	**0.876**	**0.869**	**0.527**
Task and technology fit	**0.842**	**0.836**	**0.526**
Task characteristics	**0.926**	**0.935**	**0.619**
Technology characteristics	**0.924**	**0.915**	**0.661**

Cronbach Alpha and composite reliability primarily used to check the internal consistency evaluation in the construct reliability. From the above table, it makes clear that cronbach alpha and composite reliability secures values to be higher than 0.80. The values exhibited that scales were reasonably reliable and at the same time latent variables value greater than the minimum threshold level of 0.70. To prove this, AVE calculated and the values are higher than 0.50 . Hence convergent validity is confirmed for the above stated model. Finally, the results clearly depicted that the good convergent validity seen and at the same time internal consistency found to be good.

Fornelllarcker criterion test

Particulars	p	TTF	TC	TEC
Performance	0.477			
Task and technology fit	0.584	0.355		
Task characteristics	0.370	0.624	0.565	
Technology characteristics	0.118	0.482	0.118	0.511

Where(P represents performance, TTF represents task and technology fit, TC represents task characteristics and TEC represents Technology characterstics)

From the above table, it makes clear that the squared correlation compared with the correlations from other varirables using Fornelllarcker criterion test. The values depicting that it is smaller than the squared root of average variance and hence it implies satisfactory discriminant validity.

Evaluation of inner structural model

The measurement is showing valid and reliable and the next step is to assess the inner structural model using coefficient of determination followed by path coefficient, t statistics value and effect of size. These are considered to be the key standards especially for evaluating the inner structural model.

Measuring the effect size

Measuring effect size is the impact of each construct on the endogenous latent variable. When an independent variable deleted from the path model, it alters the value of the R square and defines whether the removed variable has an impact on endogenous latent variable .F square values of 0.35 represents strong effect, 0.15 shows moderate effect and 0.02 represents weak effect. From the below table, it makes clear that task and technology fit, task characteristics and technology characteristics secured values of 0.517, 0.737 and 0.383 respectively. Hence, all the exogenous variable has a strong effect on the value of R square

Exogeneous latent variable	Effect size f^2	Effect
Task and technology fit	**0.517**	**Strong**
Task characteristics	**0.737**	**Strong**
Technology characteristics	**0.383**	**Strong**

Standardised root mean square residual

It is an index of the average of standardised residuals among the observed and the hypothesized covariance matrix . Generally, SRMR applied to measure the estimated model fit. The below table

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depicts that SRMR is 0.001 which is lesser than 0.08 and hence the model has found to be good fit for the study . Besides, chi-square value to be 710.638 and NFI equal to 0.030 was also measured.

Particulars	Estimated Model
SRMR	0.001
d_ULS	11.611
d_G	6.926
Chi-Square	710.638
NFI	0.030

Measuring the value of R square

The value measures the overall effect size and variance which is explained in the endogenous construct for the structural model which measure the model predictive accuracy. In this study, inner path model is 0.741 for the performance and 0.558 for the task and technology fit. Hence the two attributes constructs substantially 55.8% of variance in the task characteristics and technology characteristics and task and technology fit have 34.1% of variance in the performance. Henseler et al and Hair et al has stated that R square value of 0.26 to be weak, 0.50 as moderate and 0.75 to be substantial. Therefore the present study has a performance value is substantial whereas task and technology fit has a moderate effect.

Particulars	R Square	R Square Adjusted
Performance	0.741	0.321
Task and technology fit	0.558	0.530

Latent variable correlation

	P	TTF	TC	TEC
Performance	1.000			
Task and technology fit	0.584	1.000		
Task characteristics	0.370	0.624	1.000	
Technology characteristics	0.118	0.482	0.118	1.000

With the help of the measurement models and structural model, it is highly determined because hypothesis are statistically significant and hence it is accepted. The results of the study stated that all variables of task and technology theory support the performance impact in oil and gas companies in Nigeria.

Estimation of path coefficient and T statistics

PLS path coefficient and standardised coefficient results from regression analysis are similar. With the help of β value, hypothesis testing conducted. If β value is greater, then the substantial effect on endogenous latent variable to be higher. To test the significance of the path coefficient and T statistics value, bootstrapping carried and exhibited the results below. Hence the variable task and technology fit participated relatively to the greater value of 34.1% in the dependent variable whereas task and technology characteristics participated relatively greater value of 55.8% of the dependent variable.

Particulars	Standardised beta	T Statistics	P Values
Task and technology fit -> Performance	0.584	0.834	**0.00**
Task characteristics -> Task and technology fit	0.575	1.900	**0.05**
Technology characteristics -> Task and technology fit	0.414	0.963	**0.03**

Technology characteristics influenced task and technology fit ($\beta = 0.414$, $T = 0.963$, $p < 0.005$). Hence it is highly supported. With regard to task characteristics and task and technology fit ($\beta = 0.575$, $T = 1.990$, $p < 0.005$). Thus ,it is statsically significant. Considering task and technology fit and performance, ($\beta = 0.584$, $T = 0.834$, $p < 0.005$). Finally, the results stated that task and technology fit significantly influenced the individual performance in oil and gas companies in Nigeria. Finally, the greater beta coefficient ,the strong effect of exogenous latent variables on the endogenous latent variables.

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VII. FINDINGS AND DISCUSSION

From the survey outcome, it makes clear that industrial intranet widely implemented in oil and gas maintenance department which is used in major oil and gas companies in Nigeria. Industrial intranet considered to be the most significant sources of information which clearly exhibits the operation of industrial assets of the organization. Maximum number of respondents stated that only one industrial intranet widely used based on their purpose of the organization. Industrial intranet provides industrial assets information, work instructions, guidelines and process description to the user. Most of the industrial information intimates to the user via emails and weekly summaries. This in turn makes the employees to take necessary action even before stoppage of machineries in the production line. Hence, many employees stated that industrial intranet is vital for maintenance department to monitor the assets of oil and gas companies.

However, PLS-SEM depicts as an effective technique for investigating the complex models, validate it accordingly. Here, the conceptual paths of task and technology fit theory estimated using SEM based PLS techniques. The results of the study revealed that task characteristics have a positive influence on task and technology fit ($\beta = 0.575$, $T = 1.990$, $p < 0.005$) followed by technology characteristics have a positive influence on task and technology fit ($\beta = 0.414$, $T = 0.963$, $p < 0.005$) and at last task and technology fit have a positive influence on performance ($\beta = 0.584$, $T = 0.834$, $p < 0.005$). Hence, the findings of the present study consistent with the Goodhue results. Finally, the study found that there is a positive association between task technology fit and performance and hence the companies are more likely to utilise industrial intranet for maintenance department the high productivity achieved

VIII. CONCLUSION

It is observed from the study that only one common intranet is available for each oil and gas companies which provides an update information on industrial assets information to be in cloud data base. Top management level of people have the power to access industrial intranets in the organization. Most of the information is available to the users in the form of emails and weekly summaries of the industrial assets of the equipment. However, the study challenged for the researcher to fix original task technology fit theory to be applicable for industrial intranet especially for oil and gas companies. With the help of correlational approach, it makes clear that variables are highly correlated to one another. Finally, task characteristics and technology characteristics have an impact on task and technology fit followed by task and technology fit have an impact on individual performance of oil and gas companies in Nigeria.

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