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A Study of the Modificative Role of Human Capital on Adoption, Agility and Technology Diffusion as Mediators for Achieving an Optimal Change Management

Rahil Meymandpour*, Prafulla Pawar**, Zahra Bagheri***

Abstract

This study is carried out with the aim of investigating the deterministic role of human capital for enhancing adoption and agility in the diffusion process of a new technology in order to implement technological changes satisfactorily. This causal relationship is carried outbased on five variables; human capital, adoption, agility, technology diffusion and change management measured through five questionnaires with 71 statements distributed among 432 IT employees in Pune-India. The collected data are analyzed through IBM SPSS 23, LISREL 8.5 and Mplus 6.12. However, the data analysis shows that there is a positive relationship between human capital, adoption, agility and technology diffusion as predictor variables with change management as a criterion variable, the interaction of adoption, agility and technology diffusion is not significant to support the proposed model of this study. This is while, human capital as the main independent variable could be placed in two modified models to examine the mediating roles of adoption and agility for a satisfactory change management in one model as well as the mediating role of technology diffusion in another model. It can be concluded that employees' human capital as a main independent variable can enhance employees' adoption and agility in technology diffusion to proceed a satisfactory technological

* Ph.D. Student, Department of Management Sciences, Savitribai Phule Pune University, Pune, Maharashtra, India. Email: meymandpour.rahil@yahoo.com
** Professor, Department of Management Sciences, Savitribai Phule Pune University, Pune, Maharashtra, India. Email: mypumba@gmail.com
*** Associate Professor, Department of Biostatistics, Shiraz University of Medical Sciences, Shiraz, Iran. Email: bagherizb@gmail.com

change management. In other words, human capital is recognized as an essential capability in proceeding technological changes.

Keywords: *Human Capital, Adoption, Agility, Technology Diffusion, Technological Change Management*

INTRODUCTION

In spite of a huge number of the conveniences provided by technology, organizations have to challenge with the changes occurring due to this phenomenon time after time (Stohr & Zhao, 1997). In other words, they have to update and fit themselves according to the recent changes of technologies to attain ideal outcomes out of these changes for more organizational developments (Popper, 2003). In response to technological developments, organizations may adopt or may die (Lin & Hui, 1997). Then, they must attempt to create solutions for encountering changes to win this competition and get relief of elimination (Siddiqui & Rahman, 2012). The winners of these competitive changes are those responding and adopting changes promptly. While the losers are ones who try to control the changes in environment but not try to accept them (Pryor, Taneja, Humphreys, Anderson, & Singleton, 2008). Organizations need an ability to adopt themselves to the continuous changes occurring in their environment (Andresen & Gronau, 2006). Indeed to have an influential change management, they have to assess their ability of adopting change (Gosh, Sharma, & Mohabay, 2011). The first motif required to be noticed is employees as a practical being in implementing organizational technologies. Thus, employees' capabilities contributing in satisfactory technological changes have to be taken into account. The role of a new technology would become meaningful in organizational development only if it is diffused extensively (Hall & Khan, 2002). It is proposed that adoption and agility can be the major elements in diffusing new technologies which are increased via human capital (Pawar & Meymandpour, 2017). As in organizational developments, the collaboration of adoption and agility is recognized as influential managerial programs in changing era (West & Grant, 2010). Being demanded abilities in technological changes, adoption (Davis, 1989) and agility (Goldman, Nagel & Preiss, 1995; Dunlop-Hinkler, Parente, Marion & Friar, 2011) are categorized as human capital whose importance is not neglected by organizations. It means that employees can be more

adoptive and agile in technological changes whenever their vintage-specific human capital may be acquired either through education and learning or through experience and working. Since introducing a new technology produces new occupations requiring new abilities as well (Schütz et al., 2013). Inspirationally, assuming human capital; this crucial feature as a main independent variable, this study gives color to human capital affecting the mediating roles of adoption, agility and technology diffusion for achieving an optimal technological change management.

LITERATURE REVIEW

Perusing literature review, anyone would find that the works dealing with all constructs studied in this paper are rare or in some cases, these constructs are not pointed out directly. For example, Song (2009) declares in his work that an agile adoption in changes leads change processes to be fulfilled satisfactorily. Though generally scholars aver that for increasing adoption and agility in technological change management or for being adoptive and agile in technology diffusion, human capital is an essential construct which should be involved in technological change management (Rosenberg, 1972; Chari & Hopenhayn, 1987, 1991; Attewell, 1992; Venkatesh & Davis, 1996; Kandt, 2002; Qin & Nembhard, 2010; Yaghoubi & Rahat Dahmardeh, 2011). Meanwhile, in his model; Bass model or Bass diffusion model, Bass (1969) emphasizes on individual's innovativeness as a human capital for increasing speed of adoption of new technology. His model consists of differential equation to demonstrate the length of time taken for adopting a new technology from the initiation of its usage till the peak of its usage that is diffusion of technology. Lyytinen and Rose (2004) believe that during maturation of IT innovations, time which is defined by speed and agility presents in different stages of technology diffusion. Since Mathiassen and Pries-Heje (2006) opine that agility is a quality which might be required during a change process showing the speed of time evaluated for the level of a technological change implementation. Haeckel (1999) purports that agility demonstrates the length of time spent during the innovation of technology till its peak of implementation. Rogers (1983) inducts the diffusion of new technology through the rate of adoption and the passage of time which is the speed of the adoption process. He mentions that individuals' ability influence the rate of adoption and the length of time taken for this adoption. Hall and Khan (2002) aver that the rate of diffusion is determined through

adopting a new technology at a point of time. In other words, the less lateness of adoption, the more rate of diffusion indicating that the speed of adoption of new technology demonstrates the rate of the diffusion of that technology. It seems that adoption and agility are integral parts of diffusion process. In addition to this, since diffusion process is an abstract term (Strang & Soule, 1998); it requires to be demonstrated through concrete elements such as adoption and agility. Comin and Hobijn (2009) point that the rate of technology diffusion depends on time lags of technology adoption. Similarly, Comin, Dmitriev, and Rossi-Hansberg (2012) model the diffusion of technology through time and space illustrating that they are interrelated to each other since estimation of adoption of diffusion over space would lead to estimation of speed of diffusion over time. On the other hand, they opine that knowledge related to new technology is required as a human capital since it would maximize the space and time of technology diffusion. Likewise, in his model Dove (2005) emphasizes on knowledge and skill as human capital playing like a fuel of agility in change management. Bartel and Lichtenberg (1987) demonstrate that the skills related to technology as a human capital would be a main enhancer in diffusing a new technology. Benhabib and Spiegel (2005) generalize the Nelson-Phelps catch-up model of technology diffusion which is facilitated through the levels of human capital. Furthermore, in their work; Messinis and Ahmed (2008) extend Benhabib and Spiegel's model in which they develop index of human capital as a determinant capacity in adopting technological change and diffusing new technology. Comin and Mestieri (2014) pattern technology adoption over time and through technology diffusion in which they emphasize on human capital as a driver of technology adoption. Additionally, Pawar and Meymandpour (2017) propose a conceptual model for a satisfactory change management in which employees' human capital enhances employees' adoption and agility for diffusing new technology leading to a technological change management. They assert that adoption and agility are the components of technology diffusion indicating that the more adoption and agility in new technology, the more diffusion in that technology. Up to now, it becomes clear from the literature review that in order to flourish a technological change process satisfactorily; on the one hand, human capital is recognized as a determining driver in diffusing technology. On the other hand, technology diffusion process consists of elements such as rate of adoption and time lags which determine the intensity of technology diffusion. Herein, the time lag is demonstrated through agility faculty showing

that as far as diffusion process is an abstract term required to be defined through elements including adoption and agility. Then, a complexity is formed containing adoption, agility and diffusion. The components of this complexity are interrelated to each other, affected by human capital and are main factors in managing technological changes. Accordingly, this study investigates a conceptual model adopted from Pawar and Meymandpour's model (2017) to test the relationship between the constructs involved in this model. So the model of this study illustrates that firstly, human capital variable might affect adoption, agility and diffusion variables directly as well as technological change management variable directly and indirectly. Secondly, each variable in the interrelated complexity of adoption, agility and technology diffusion can affect technological change management variable. Meanwhile, these three components are interrelated to each other.

RESEARCH METHODOLOGY

In the light of the literature review, the main aim of this study would make sense that is the investigation of the impact of human capital for enhancing adoption and agility in diffusion process of technology to implement technological changes satisfactorily. So in the following the objectives of this study are set:

- To study the effect of human capital on mediating roles of adoption, agility and technology diffusion in technological change management.
- To study the direct effect of human capital on technological change management.
- To study the relationship of adoption, agility and technology diffusion with technological change management.
- To study the effect of adoption on agility.
- To study the difference of means of the independent variables of this study (human capital, adoption, agility and technology diffusion).
- To study the serial correlation between the studied variables.
- To study the interaction of human capital, adoption, agility and technology diffusion on change management.

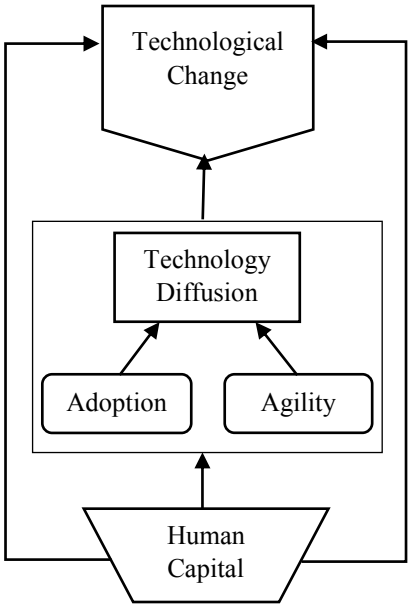

Fig. 1: Conceptual Model of This Study Adopted from Pawar and Meymandpour (2017)

As it is obvious from Fig. 1, it is assumed that human capital has impact on adoption, agility and technology diffusion, then they all lead to technological change management. So human capital can affect technological change management directly and indirectly. Therefore, the complexity of adoption, agility and technology diffusion can affect technological change management through human capital which is recognized as the independent variable. With regard to this model, the main hypotheses can be developed as the following:

H1: Human capital has an effect on mediating roles of adoption, agility and technology diffusion in technological change management.

H2: Human capital has a direct effect on technological change management.

H3: Adoption, agility and technology diffusion have a relationship with technological change management.

H4: Adoption has a significant effect on agility.

H5: There is a difference between the means of independent variables (human capital, adoption, agility and technology diffusion).

H6: There is an order correlation between the studied variables.

H7: Human capital, adoption, agility and technology diffusion have an interaction on change management.

In order to achieve the objectives of this study and test the declared assumptions to accept or fail to accept them, the following research procedure is conducted in this current work.

This study is conducted in 200 IT companies in Pune-India out of 600 IT companies. Which are small and big size IT companies as well as national and multinational IT companies (categorized in second class IT companies: high knowledge barriers, according to Fichman, 1992) having hubs or branches in other cities of India as well as other countries which would be more than 50,000 companies. So the population of this study is determined as infinite one due to uncountable population. The sampling method is convenience sampling method known as a non-probability sampling method. Then, 432 IT employees out of around 2000 ones are in access and ready to fill the questionnaires. Around 65% of respondents are fresh employees with 1-5 years' experience. Whereas, 35% respondents are obsolescent employees with 6-20 years' experience. Meanwhile the calculation of sample size is taken from the required sample size table of Research Advisors (2006) which is in accordance with Krejcie and Morgan's sample size determination (1970). As the respondents are volunteer to fill the questionnaires, none of the respondents escape any question during data collection. It is because the data collection is carried out directly in IT companies. Besides, the questionnaires are distributed through face-to-face contact in which some reply back via E-mails. The respondents are informed that in the current survey, new technology is recognized as the programs they deal with to produce their companies' products. The details of sample demography are illustrated in a demographic table shown in Table 1:

Table 1: Descriptive Data of Sample Demography

	Fresh Employees	**Obsolescent Employees**
Age	**Frequency**	**Frequency**
22-30	280	-
31-55	-	152
Gender		
Male	161	89
Female	119	63
Education		
Graduated	186	84
Post-Graduated	94	68
Experience		
1-5 Years	280	-
6-20 Years	-	152

The primary data collection is done through 5 researcher-made questionnaires including 71 statements with a 6-point Likert Scale; 1 to 6 (strongly agree, agree, to somewhat agree, to somewhat disagree, disagree, strongly disagree, respectively). It means that the lowest mean show either the most agreement from the respondents' perspective or vice versa. Besides, neutral option is omitted since it is found that neutral option does not show respondents' real opinion so the true essence is not achieved and it would be as an escape for the respondents. These questionnaires are Human capital (consisting of 12 statements; extracted from Sharabati, Naji Jawad, & Bontis' questionnaire, 2010); adoption (consisting of 12 statements; extracted from Taylor, & Todd's questionnaire, 1995); agility (consisting of 12 statements; extracted from Zhang's model of agility capabilities, 2011); technology diffusion (consisting of 19 statements; extracted from Sonnenwald, Maglaughlin, & Whitton's questionnaire, 2001); and technological change management questionnaires (consisting of 16 statements; extracted from Cummings, & Worley's model of activities contributing to effective change management, 2008). It is worthwhile to note that the feasibility of the questionnaires is proved through a pilot study carried out before conducting this research. In the following the conceptual model of this study illustrating the variables and their dimensions are shown.

The respondents are asked for expressing their experience of how they deal with new technology that is field of experiment approach of data collection regarding acceptance technology (Rogers, 1983). At the end of the questionnaire, the respondents are asked for expressing more issues on new technology as well. IBM SPSS 23, LISREL 8.5, Mplus 6.12 are applied to carry out descriptive and inferential analyses.

Reliability and Validity

For measuring consistency and accuracy of the research questionnaires, internal consistency reliability and exploratory factor analysis are carried out through cronbach's alpha and principle component analysis, respectively. Through achieved results, variables have approximately $\alpha > 0.80$. KMO test, percentage of variances and factor loadings show significant figures in factor analysis as well.

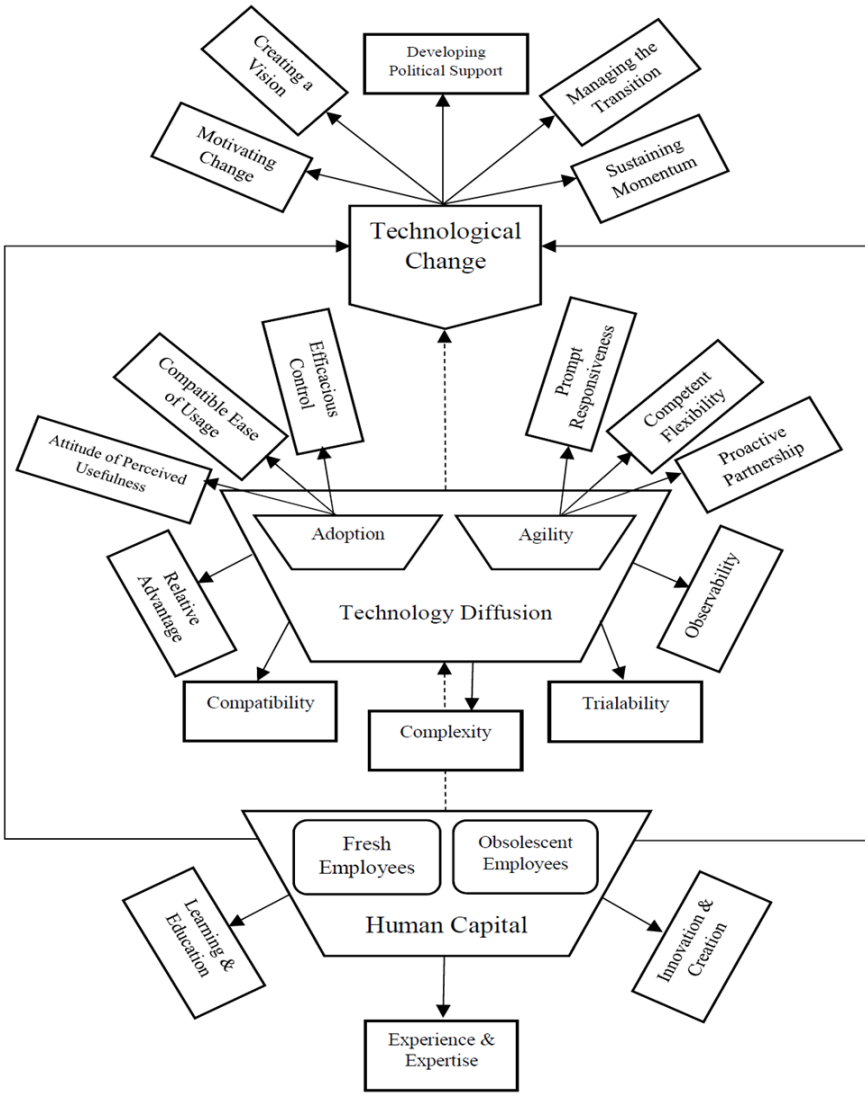

Fig. 2: Representation of Variables and Sub-Variables in the Proposed Conceptual Model of This Study

DATA ANALYSIS

Arguing that how human capital can affect the mediating roles of adoption, agility and technology diffusion for a satisfactory change management, descriptive data are presented to compare the means of the

variables and the impacts of human capital attributions. The mean of each variable is calculated in accordance with 6-point Likert Scale of this study (from strongly agree got point 1 to strongly disagree got point 6). So, the highest means of the variables show the highest disagreements from the respondents' point of view. While, the lowest means show the highest agreement from their point of view as shown in Table 2:

Table 2: Descriptive Data of the Variables

Variable	N	Minimum	Maximum	Mean	Std. Deviation
Human Capital	432	15.00	69.00	31.1551	8.81054
Adoption	432	14.00	45.00	27.1227	6.08686
Agility	432	12.00	59.00	27.2708	6.75067
Technology Diffusion	432	25.00	70.00	43.9306	8.15851
Change Management	432	16.00	84.00	38.3287	11.42527

Accordingly, in Table 2, adoption shows the highest agreement from the respondents' perspective while technology diffusion shows the highest disagreement. A comparison of the means of the variables between the two groups of the respondents is done through an independent t test which is demonstrated in details in Table 3:

Table 3: Descriptive Data of Two Groups of the Respondents

Variable	Employee	N	Mean	Std. Deviation	Std. Error Mean
Human Capital	Fresh	280	31.6714	8.91492	.53277
	Obsolescent	152	30.2039	8.56246	.69451
Adoption	Fresh	280	27.2036	6.41330	.38327
	Obsolescent	152	26.9737	5.45171	.44219
Agility	Fresh	280	27.3714	7.07750	.42296
	Obsolescent	152	27.0855	6.12123	.49650
Technology Diffusion	Fresh	280	43.7893	8.39281	.50157
	Obsolescent	152	44.1908	7.72862	.62687
Change Management	Fresh	280	38.5357	11.96944	.71531
	Obsolescent	152	37.9474	10.37559	.84157

Obsolescent employees show more agreement in all the variables in comparison with fresh employees.

Additionally, to realize how human capital as the main independent variable can affect other variables, a hard look at its subscales would be required. Then, in Table 4, it is concentrated on the difference between fresh and obsolescent employees' human capital.

Table 4: Descriptive Data of Human Capital Dimensions of Two Groups of Respondents

Subscale	Employee	N	Mean	Std. Deviation	Std. Error Mean
Education	Fresh	280	9.8643	3.36056	.20083
	Obsolescent	152	9.8618	3.38882	.27487
Experience	Fresh	280	11.5286	3.41291	.20396
	Obsolescent	152	10.5526	3.10477	.25183
Innovation	Fresh	280	10.2786	3.38364	.20221
	Obsolescent	152	9.7895	3.45191	.27999

Besides, the subscales of human capital show that the means of education of fresh and obsolescent employees are approximately same. The highest means of experience and innovation belong to fresh employees indicating that fresh employees have the highest disagreement in experience and innovation. These descriptive data are announced to diagnose the most educated, experienced and innovative respondents are associated to whom. Then, it can be interpreted that the role of human capital variable goes back mostly to fresh employees or obsolescent employees. Otherwise, this study is not a comparative one but rather a correlational one attempting to find the causal relationships between the variables and their interactions on each other.

Further, inferential statistics is carried out in order to find out whether the assumed dependent variable has significant positive relationship with the four independent variables:

Table 5: Pearson Correlation of Five Variables N = 432

Row	Studied Variables	1	2	3	4
1	Human Capital	-			
2	Adoption	0.38**	-		
3	Agility	0.52**	0.63**	-	
4	Technology Diffusion	0.52**	0.58**	0.56**	-
5	Change Management	0.60**	0.42**	0.54**	0.47**

** Correlation is significant at the 0.01 level (2-tailed)

As it is clear from Table 5, all five variables have significant correlation with each other with the level of significance of 0.01. The figures showed option and technology diffusion have the least significant correlation with change management while human capital shows the most. On the other hand, adoption and agility show the highest correlation with each other illustrating in Table 5.

In addition to correlation analysis to find out whether the variables correlate with each other significantly, a Durbin-Watson test is carried out to find out whether there is any autocorrelation between the variables or not. So, in Table 6 the achieved figures are displayed:

Table 6: Durbin-Watson Test

Model Summary[b]					
Model	**R**	**R Square**	**Adjusted R Square**	**Std. Error of the Estimate**	**Durbin-Watson**
1	.666[a]	.443	.438	8.56465	1.932

a. Predictors: (Constant), human capital, adoption, agility, technology diffusion

b. Dependent Variable: change management

It is clear from Table 6 that there is significant positive serial correlation between the variables while Durbin-Watson test shows the level of significance less than 2. Then, the figures illustrate that there is a positive autocorrelation between the studied variables in this study.

Furthermore, in order to compare the means of independent variables of this study and to examine whether the differences between the means of independent variables are statistically significant, one way analysis of variance (ANOVA) is carried out in this current study. And the achieved results are shown in the following.

Table 7 illustrates the results of F test carried out through ANOVA show there is a significant difference between the means of predictor variables:

Table 7: One Way Analysis of Variance

ANOVA[a]						
Model		**Sum of Squares**	**df**	**Mean Square**	**F**	**Sig.**
1	Regression	24939.494	4	6234.873	84.998	.000[b]
	Residual	31321.830	427	73.353		
	Total	56261.324	431			

a. Dependent Variable: change management

b. Predictors: (Constant), human capital, adoption, agility, technology diffusion

It is clear from Table 7, there is a significantly difference between the group of predictor variables with level of significance less than 0.05, which is realized by one way analysis of variance in this study with F = 85 and P-value = 0.000.

Additionally, a regression coefficient analysis is carried out to detect the causal relationship between the variables. The achieved figures are shown in Table 8:

Table 8: Regression Coefficients Analysis

Coefficients[a]						
Model B		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		Std. Error	Beta			
1	(Constant)	2.178	2.379		.915	.360
	human capital	.518	.058	.400	8.964	.000
	adoption	.096	.094	.051	1.025	.306
	agility	.431	.087	.255	4.934	.000
	technology diffusion	.129	.069	.092	1.874	.062

a. Dependent Variable: change management

From Table 8, it can be said there is a positive relationship between change management as a criterion variable and the other four variables as predictor ones that are human capital, technology diffusion, adoption and agility. It can be interpreted that if human capital score increases by 1, change management increases by 0.52, if technology diffusion score increases by 1, change management increases by 0.13, if adoption score increase by 1, change management increases by 0.096, and finally if agility score increases by 1, change management will increase by 0.43. However, human capital and agility affect change management significantly with level of significance < 0.05, adoption and technology diffusion have a small proportion of effect on change management with P-value more than 0.05. Then, it can be said that the strength of the tested model is not that much significant as it is predicted. Regression analysis shows the effect of one predictor variable on criterion variables while other predictors are held fixed. So there should be other analyses to manifest the interaction

of all predictors on criterion variable at a same time.

Besides this, in order to realize that whether there is a significant interaction between the independent variables on the dependent variable, tests of between-subjects effects are carried out. Unlike, regression analysis dealing with the relationship between the dependent variable and independent variables while one of the independent variables is varied and the others are fixed to estimate the effect of one of the independent variables on dependent variable, here the interaction of all independent variables on dependent variable is estimated. So, in Table 9 the achieved results of tests of between-subjects effects are illustrated as the following:

Table 9: Tests of Between-Subjects Effects

Dependent Variable: Change Management					
Source	**Type III Sum of Squares**	**df**	**Mean Square**	**F**	**Sig.**
Corrected Model	56247.824[a]	409	137.525	224.115	.000
Intercept	437861.357	1	437861.357	713551.840	.000
human capital	186.787	17	10.987	17.905	.000
adoption	1077.329	15	71.822	117.043	.000
agility	14.600	12	1.217	1.983	.079
technology diffusion	17.198	37	.465	.757	.777

a. R Squared = 1.000 (Adjusted R Squared = .995)

It is clear from Table 9 that with regard to the interactions of all independent variables together (human capital, adoption, agility and technology diffusion) on the dependent variable (change management), human capital and adoption show a significant interaction on change management with P-value = 0.000. Whereas, agility and technology diffusion do not show a significant interaction on change management with the level of significance more than 0.05.

Accordingly, SEM is applied in order to test the significance of the linear relationship of the variables in the proposed model as well as the fit indices. The tested model with the estimated figures is illustrated in Fig. 3:

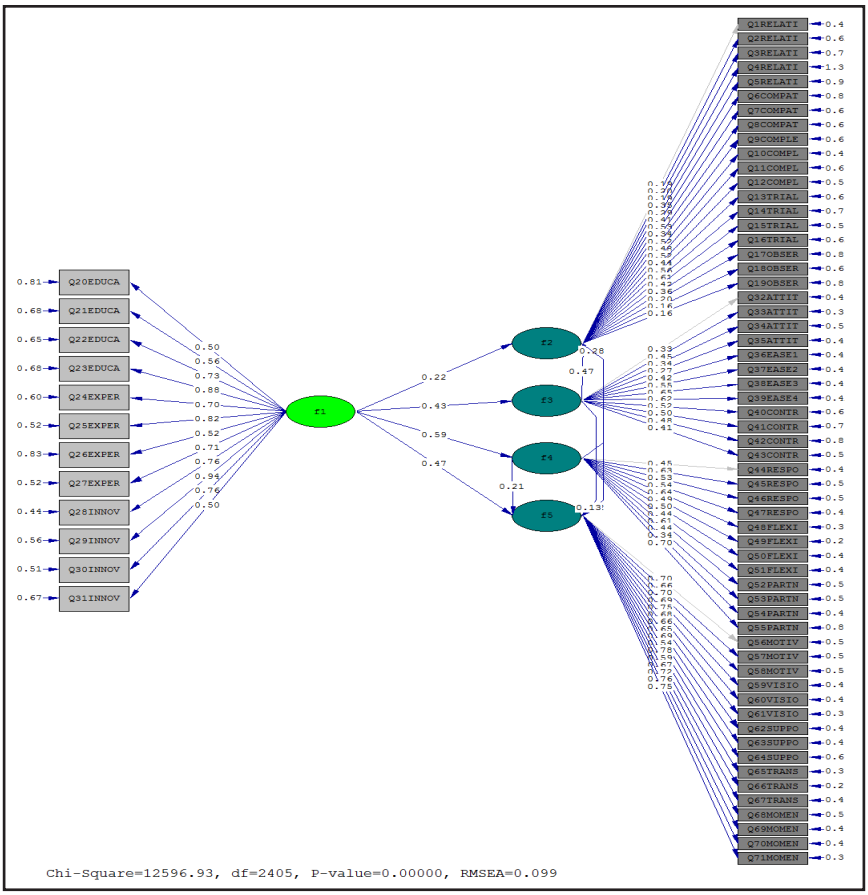

Fig. 3: Achieved Model in SEM in Accordance with the Proposed Conceptual Model of the Relationship Between Human Capital, Technology Diffusion, Adoption, Agility and Change Management with Estimated Figures

f1: human capital, f2: adoption, f3: agility, f4: technology diffusion, f5: change management

According to Fig. 3, human capital shows a significant effect on technology diffusion and change management with estimates figures of 0.59 and 0.47, respectively. Similarly, adoption shows a significant effect on agility with estimates figure of 0.47. Besides, adoption shows approximately a significant effect on change management with the estimate figure of 0.28. Although, agility and technology diffusion with estimates figures of 0.13, and 0.21, respectively, do not show a significant relationship with change management. It means that a linear combination

of the studied variables does not show statistically a significant relationship among all the variables. However the estimated figures demonstrate that there are positive relationships between variables, the interactions of all variables do not show statistically a significant figures.

Table 10 illustrates the fit indices of the tested model and their optimal cut-off point.

Table 10: Fit indices of the Tested Model and the Optimal Cut-Off Points

Row	Fit indices and their optimal cut-off point	Figures
1	Chi-Square (P=0.00)	12596.9
2	Degree of Freedom (DF)	2405
3	Comparative Fit Index (CFI) ≥ 0.95	0.86
4	Normed Fit Index (NFI) ≥0.95	0.83
5	Root Mean Square Error of Approximation (RMSEA) ≤ 0.08	0.099

However, the achieved cut-off points do not show ideal figures in Table 10, they, to some extent, indicate a good-fit model for the data. Additionally, it is assumed that RMSEA figure of 0.08-0.10 provides a mediocre fit (MacCallum et al., 1996). By and large, the indices illustrated in Table 10 shows approximately a good-fitting model of this study and the tested model is a valid one for the collected data of this research. As far as the conceptual model does not give an optimal good-fitting model, the proposed model is modified through omitting technology diffusion in one set and adding technology diffusion to another model according to the model modification indices in Mplus software. It is tried to model the relationship of the variables through the collected data again to give an optimal good-fitting model. Consequently, the achieved figures through Mplus software are shown in Tables 11 and 12:

Table 11: Model Results for Human Capital, Adoption, Agility and Change Management Relationship

Estimate S.E.	Est./S.E.	P-Value (Two-Tailed)		
Agility on Human Capital	0.398	0.032	12.621	0.000
Adoption on Human Capital	0.266	0.031	8.682	0.000

CHANGE	ON			
AGILITY	0.462	0.086	5.397	0.000
ADOPTION	0.155	0.088	1.765	0.078
HUMAN CAPITAL	0.552	0.055	10.049	0.000

Table 11 shows the estimate figures of the impact of human capital on adoption and agility for increasing change management and then the impacts of human capital, adoption and agility on change management.

Table 12: Model Results for Human Capital, Technology Diffusion and Change Management

Estimate S.E.	Est./S.E.	P-Value (Two-Tailed)		
DIFUSSION ON	ON			
HUMAN CAPITAL	0.398	0.032	12.621	0.000
CHANGE ON	ON			
DIFUSSION	0.266	0.031	8.682	0.000
HUMAN CAPITAL	ON			

Table 12 illustrates the estimate figures of the impact of human capital on technology diffusion for increasing change management and then the impacts of human capital and technology diffusion on change management.

Besides, CFI and TLI as fit statistics are 1.00 in both modeling that are the ideal standard showing that both tested models are optimal good-fitting models.

The achieved figures illustrate that human capital significantly increases technological change management directly as well as indirectly through impacting adoption, agility and technology diffusion. Adoption and agility increase technological change directly as well as indirectly through human capital. Technology diffusion increases technological change management directly as well as indirectly through human capital. In model modification, impact of technology diffusion is tested separately, then it gives significant good-fitting model and ideal cut-off points as well. However, in previous model, the interaction of adoption, agility and technology diffusion cause model not to show optimal good-fitting model as well as ideal cut-off points. Herein, the influential function of human capital gives significance in mediating roles of adoption, agility and technology diffusion for perceiving a satisfactory change management.

According to the related tests, the achieved figures lead to accept or fail to accept the hypotheses of this study presented in details:

H1: *Human capital has an effect on mediating roles of adoption, agility and technology diffusion in technological change management:*

According to structural equation modeling, the results show that human capital has a significant effect on mediating roles of adoption, agility, and technology diffusion in change management. Therefore, through the achieved results, the hypothesis is accepted.

H2: *Human capital has a direct effect on technological change management:*

According to structural equation modeling, the results show that human capital has a statistically significant direct effect on change management. Therefore, through the achieved results the hypothesis is accepted.

H3: *Human capital, adoption, agility and technology diffusion have a relationship with technological change management:*

According to regression analysis test, the achieved results show that human capital and agility have a significant relationship with change management. While, the results indicate that adoption and technology diffusion do not have a significant relationship with change management. Therefore, through the achieved results the hypothesis regarding the significant relationship of human capital, agility and change management would be accepted. Whereas, the hypothesis regarding the significant relationship of adoption, technology diffusion and change management would be failed to accept, consequently.

H4: *Adoption has a significant effect on agility.*

According to structural equation modeling (SEM), the achieved results show that adoption has a significant effect on agility. Therefore, through the achieved results, the hypothesis regarding the significant effect of adoption on agility would be accepted, consequently.

H5: *There is a difference between the means of independent variables of this study (human capital, adoption, agility and technology diffusion):*

According to one way analysis of variance (ANOVA), the achieved results show that there is a significant difference between the mean of independent variables of this study (human capital, adoption, agility, and technology diffusion). Therefore, through the achieved results the hypothesis regarding the difference between the means of the independent variables is accepted.

H6: *There is a positive serial correlation between the studied variables*.

According to Durbin-Watson test, the achieved results show that the studied variables have a significant autocorrelation with each other. Then, there is an order correlation between the variables with Durbin-Watson less than 2. Therefore, through the achieved results the hypothesis regarding the serial correlation between the studied variables would be accepted.

H7: *Human capital, adoption, agility and technology diffusion have an interaction on change management:*

According to tests of between-subjects effects and structural equation modeling (SEM), the achieved results show that human capital and adoption have a significant interaction on change management. While, agility and technology diffusion do not show a significant interaction on change management. Therefore, through the achieved results the hypothesis regarding the significant interaction of human capital and adoption on change management would be accepted. Whereas the hypothesis regarding the significant interaction of agility and technology diffusion would be failed to accept.

DISCUSSION

With regard to respondents' opinions about issues of new technology in their companies and the implications of achieved results; it is recognized this is an implementer who determines the structure of implementing the technology. Then, implementers try to manipulate usage structure of technology in accordance with their abilities and other sources. As far as nowadays employees' empowerment in accomplishing technology makes them deterministic elements in structuring and reshaping the context of technology use. This finding can be presumed as Structuration Theory in which the users reshape the structure of technology implementation (DeSanctis & Poole, 1994; Majchrzak et al., 2000).

According to the attained findings of the data collection, it can be averred that in technological changes of IT companies in Pune-India, the most decisive factor which can affect employees' function to be adoptive and agile in diffusion of new technology can be referred to the coordination between their abilities they possess and the abilities which are demanded for implementing new technology. As the data analysis indicates that IT employees' adoption, agility and human capital have the highest mean respectively in comparison with the other variables, while technology diffusion has the lowest mean among the variables of

this study. These results indicate that IT employees have enough abilities to enhance their adoption and agility for a change management process. Although the data show that IT employees' diffusion of technology is the least. So, it can be said that however, employees have enough abilities in adoption and agility, their abilities in adoption and agility do not match with the abilities are required in diffusion of technology. Due to this mismatch, their adoption, agility and technology diffusion could not fit in a same model. Although there are other confounding variables affecting this misfit in the collected data since they are not controlled, the main reason which is observed is the mismatch of employees' abilities with the required abilities in implementing technological changes. This mismatch may be considered as the confounding variable which is not studied or controlled during data collection. Then, the person-job fit theory should be noticed during the diffusion of new technology in an organization as well as innovation-system fit.

MANAGERIAL IMPLICATIONS

Human capital as a main input variable could show remarkably a significant effect on the other variables either directly or indirectly in this study. This covers definitely obsolescent employees' human capital consisting education, experience and innovation together. Then, it should be noted from a managerial point of view that for enhancing employees' adoption and acceptance in new technology; their capabilities and abilities related to that new technology should be considered. However, this study does not try to compare fresh and obsolescent employees with each other. Since it is found in studies related to human capital that both fresh and obsolescent employees' human capital are required in technological changes since both together are adoptive and agile in getting and implementing changes as each category would have its own advantages for technological changes in organizations (Kredler, 2008; Meymandpour & Pawar, 2018).

According to the respondents' opinions; today due to being acquainted with technological changes, employees' adoption and agility in diffusing technology would not come in a sharp downward trend like the past models of change process developed by scholars. Then, in future studies there should be an updated model of change process illustrating that the trend of technological change might not face disruption in technology diffusions. Actually, new technologies rarely face disruptive diffusion (coined by Clayton Christensen, 1997) because they are not innovative

ones to disrupt a diffusion process but updated and upgraded version of the previous ones. Thus, there might be a contiguity in diffusing technology in organizations instead of disruption in diffusing technology. Although, it cannot be claimed that disruptive technology does not absolutely appear in organizations as far as technologies are developing extensively.

CONCLUSION

Human capital significantly contributes in enhancing adoption, agility and technology diffusion for implementing satisfactory technological change. Being the most controversial issues in acceptance and implementation of new technologies, these three features are remarkably associated with human capital. Since they are human abilities which can be enhanced through enriching human capital. Furthermore, employees specially obsolescent ones show they have the required human capital to be enough adoptive and agile in technological changes as well as enough abilities to diffuse new technology adequately. But they show mismatch between their adoption and agility in technological changes and their technology diffusion. This is while the required abilities for correlating between adoption, agility and technology diffusion are not evaluated due to the scope of the study. By and large, this study could statistically support the mediating roles of employees' adoption, agility and technology diffusion for a satisfactory change management with optimal indices only in light of employees' human capital.

Scope of Future Research

The implications achieved in this study direct the future scope in focusing on the characteristics and nature of new technology in companies during diffusion of technology. As far as it is found that nowadays technological change is not issued in organizations as a turbulence of changes but stillness of updation and upgradation of changes bringing about improvement and productivity. Moreover, dealing with diffusion of technology, organizations must consider structuration theory in diffusing technology. As it is mentioned before employees' empowerment in accomplishing technology lead them to be the deterministic elements in structuring and reshaping the usage of technology. Then, this issue should be noted in future studies. On the other hand, organizations cannot follow a same predictive model of adoption and diffusion of technology to invest their missions for further successes in technological management due to the

variations of technologies, adoption contexts and environment (Fichman & Kemerer, 1993). Therefore, each organization can develop a particular diffusion of technology model to pursue and handle technological changes. Since recently in organizations technological changes are recognized as only updation and upgradation of technology, vintage-specific human capital would be decolorized during technology diffusion. Both fresh and old employees have confidence in manipulating with new technology. Therefore, organizations have to draw their attention to "Learning by Using" notion during the emergence of a new technology as well. Therefore, the notion of learning by using can be considered in researches surrounding human capital.

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