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Impact of Managerial Interventions on Process in implementing Information Systems for Higher Education Institutions in a developing country

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Abstract
Organizational Implementation of Information Systems Innovations (OIISI) Framework was developed in the context of University in Kenya and can be used to understand the implementation of Information Systems (IS) Innovations in Higher Education Institutions (HEIs). A quantitative approach to research was taken to determine the degree of associations and relationships in the OIISI framework in HEIs and, in so doing, aimed at providing researchers and practitioners with a valid and reliable instrument that covered all the key constructs identified by the framework. In this study, data was collected from identified respondents in some selected HEIs that have implemented IS or are in the implementation process, analyzed and the outcomes presented, thereby validating the relationships. Judgmental and convenience sampling design was used to select HEIs. A questionnaire based on a seven point Likert scale was administered to different participants of IS implementation in selected HEIs in Kenya and confirmatory factor analysis (CFA) used to determine regression coefficients between constructs of interest. The Chi-square goodness-of-fit test was used to test model adequacy together with other goodness of fit statistics. The null hypothesis for this test was that the model adequately accounts for the data, while the alternative was that there is a significant amount of discrepancy. To test the hypothesis, correlation coefficients were found, hypothesis tested and coefficient of determination calculated for explanation purposes. Results of this study indicates a correlation coefficient of 0.6

between Managerial Intervention (MI) and Implementation Process (IP) which is positive and significant at the 0.01 level which indicates a statistically significant relationship between MI and IP.

Key words:
Organizational Implementation of Information Systems Innovations (OIISI) Framework, Higher Education Institutions (HEIs), Managerial Interventions.

1. Introduction

Within industry, there is a growing awareness of and concern about the complexity of introducing new information technology (IT) in organizations. Experience shows that it is not so much technical issues that complicate matters, but rather organizational, social and psychological issues (Steven, 2003). Frameworks have been developed by researchers for the purpose of understanding and explaining implementation of Information Systems (IS) in organizations but many of the researchers do not necessarily go to the extent of validating the relationships indicated therein. Other researchers may take the task of validating such frameworks. Perez-Mira (2010) validated Delone and Mclean's model of information systems success at the web site level of analysis. This study aimed at testing the Organizational Implementation of Information Systems Innovations (OIISI) framework in the context of Higher Education Institutions (HEIs) in Kenya. Wausi (2009) developed the OIISI framework for understanding the implementation of information systems, case of Kenyan universities. This study used selected HEIs in Kenya to test the relationships indicated on the framework. For the purpose of this study HEI is a post-secondary institution in Kenya including Universities and Middle level Colleges.

Funding through the Kenya Education Sector Support Programme (KESSP) and other forms like Public Private Partnership (PPP) has been put into place to purchase computers and application programs including Management Information Systems (MIS). On the strength of these efforts a framework for IS implementation for Higher Education Institutions (HEIs) is needed. Wausi (2009) developed a framework for a Kenyan University as a case study. This study tests the OIISI framework for HEIs.

Peterson Obara et al., (2010) observed that despite numerous methodologies having been proposed, Kenyan parastatals still fail to effectively deal with ISs implementation and related challenges. Hackney, R. and Little, S. (1999), in Obara (2010) observed that, IS implementation in parastatals is significantly influenced by cultural, political and power behavioural situations within parastatals.

Many HEIs in Kenya like parastatals face numerous challenges in the implementation of IS. The main challenge is the lack of an appropriate framework of implementing IS in such organizations. Wausi (2009) suggested OIISI framework that can resolve this problem. However, the framework had not been tested to predict its suitability for application in HEIs. This study aimed at testing the framework for the purposes of application in HEIs.

The main aim of this study was to test the OIISI framework for the implementation of IS in Higher Education Institutions. To achieve this objective, the study was guided by some specific objectives, hypotheses and a research question. The null hypothesis of focus to this paper can be stated as follows:

H1: There is no relationship between managerial intervention and implementation process.

The study made the following assumptions and was limited as follows: The research focused on some selected HEIs which had finished implementing or were in a stage of IS implementation. Due to time and resource limitations, the researcher carried out the study in fourteen institutions, investigating between 1 and 7 respondents in every visited HEI. The researcher assumed that the variables under

investigation are measurable and the instrument used was valid and reliable to measure the variables under consideration. The results of this study were limited by the ability of the selected statistical procedure to find statistical significance. That the test had sufficient power to detect the framework relationships in the population. The study assumed that the participants were representative of the population, willingly participated in the study and that they responded to questions honestly or participated without biasing the study results. The study assumed that the results would be generalizable beyond the sample being studied and that the study would be relevant to stakeholders.

2. Theoretical Framework

Wausi (2009), Organizational Implementation of Information Systems Innovations(OIISI) Framework
Wausi(2009) developed a framework for IS implementation in HEIs (see figure 3.1 below)

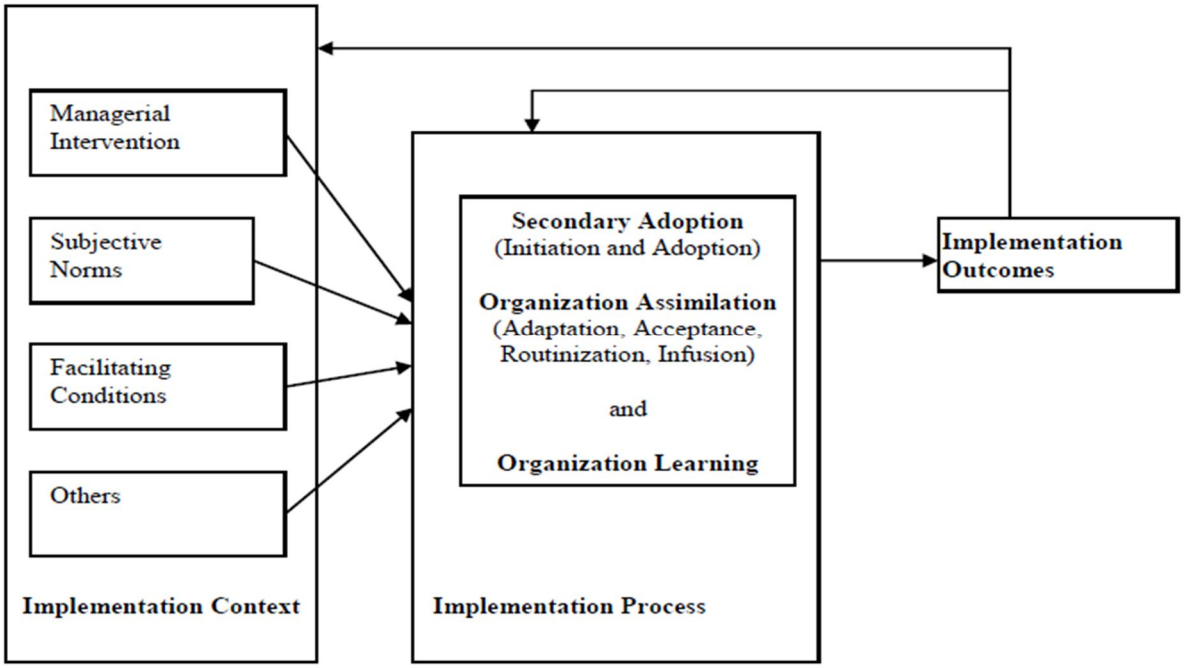

Figure 1 Hybrid theoretical framework - Implementation Context, Process and Outcomes
(Source: Wausi (2009): Organizational Implementation of Information Systems Innovations)

Wausi(2009) conceptualizes a theoretical framework for the organizational implementation process as consisting of a secondary adoption process , an organizational assimilation process and a continuous organizational learning process requiring continuous change management interventions.
Wausi(2009) further suggests that organizational implementation process happens in an organizational context and that the context influences the process. The notion of implementation contexts for IS concerns an identification of various systems and structures in an organization that influence the implementation process [Walsham 1993 in Wausi and Waema 2010].
According to this framework, Organisational implementation of information systems is a product of: Implementation Context; Implementation Process and Implementation Outcomes.
Implementation Context

The enabling factors in the implementation context are identified as: Managerial intervention; Subjective norms; facilitating conditions, all adopted from Gallivan (2001), and Others. Others is a construct that was introduced by Wausi(2009) aimed at capturing factors or issues that emerged from the case studies not covered by other key constructs. Apart from others, Wausi(2009) introduced change management in managerial intervention and organizational learning in the implementation process. A feedback loop is included to recognize the learning curve associated with the implementation process, Wausi (2009). We focus on Managerial Interventions and Implementation Process in this paper and provide operational definitions as extracted from Wausi(2009). These definitions were used to construct the research instrument.

Table 1: Managerial Interventions Construct

Construct	**Explanation**	**Operational Definitions**
Managerial Interventions	Managerial actions that are geared for creating an enabling environment	Actions and events that Indicate the provision, acquisition, allocation and enhancements of human and computing resources. These involve financial resources implicitly Indicate actions towards mandating, motivating or negotiating use of computerized application systems Infer to monitoring and evaluation process
	Change management strategies and actions taken to counter resistance and enhance the adoption and assimilation of computerized application system at unit and organizational level.	Strategies and actions taken by implementers and the organization to enhance anticipated changes in response to the implementation process. To respond to user experiences from use of the computer application system. To respond to opportunities provided by the implementation process

Table 2: Implementation Process Construct

Construct Categories	**Explanation**	**Operational Definitions**
Secondary Adoption	Events at the unit level that lead to the adoption of the computer application system	Activities and actions that indicate the initiation and decisions to adopt and use the computer application system at the unit level
Organizational assimilation	The degree of the penetration and use of the IS in the various units within an organization	Activities and events that leads to adaption, acceptance, routinization and use of computer application system; they include Actions to install/customize IS innovation, train members and facilitate use of IS innovation Actions that point to inducing user to commit to use IS innovation Indication of routine use Continued and emergent use to increase effectiveness

Organizational Learning	Key experiences of the implementation process that inform the process and the context of implementation	Reflection of experiences from process that lead to Altenative and/or modifications of the implementation context such as policies, procedures, capabilities and structures to improve performance of computer application system

Testing the Technology Acceptance Model

In a study to test the Technology Acceptance Model (TAM) in the Case of Cellular Telephone Adoption, Hyosun and Laku (2000) surveyed one hundred and seventy-six cellular telephone users about their patterns of usage, demographic and socioeconomic characteristics, perceptions about the technology, and their motivations to use cellular services. The methodology of this study designed a questionnaire with each question representing a component of the research model. Virtually all the constructs in the research model were operationalized using standard scales from the literature. Prior to the distribution of the actual survey, a pilot study involving a sample of 27 people was conducted to validate the content of the questionnaire in terms of relevance, accuracy and wording. The lessons learned from the pilot suggested some changes with respect to the instrument. The appropriate changes were made to the final questionnaire. Individuals were asked to indicate the extent of agreement or disagreement with various statements concerning cellular telephones on a seven-point Likerttype scale ranging from (1) strongly disagree to (7) strongly agree for perceived ease of use, apprehensiveness, extrinsic motivations, intrinsic motivations, and social pressure. The respondents' scores for each construct were obtained by summing across all the item scores of the individual variables. The hypothesized relationships among the study variables depicted in the model were tested using multiple regressions and path analyses.

Hyosun and Laku(2000) approach for testing TAM was adopted for this study since Wausi(2009) OIISI framework involved qualitative relations. It involved the use of questionnaires to collect data using a seven-point Likerttype scale ranging from (1) strongly disagree to (7) strongly agree for perceived constructs in the OIISI framework.

This study conceptualizes the study as follows with only one hypothesis(H1) indicated on the diagram for purposes of this paper.

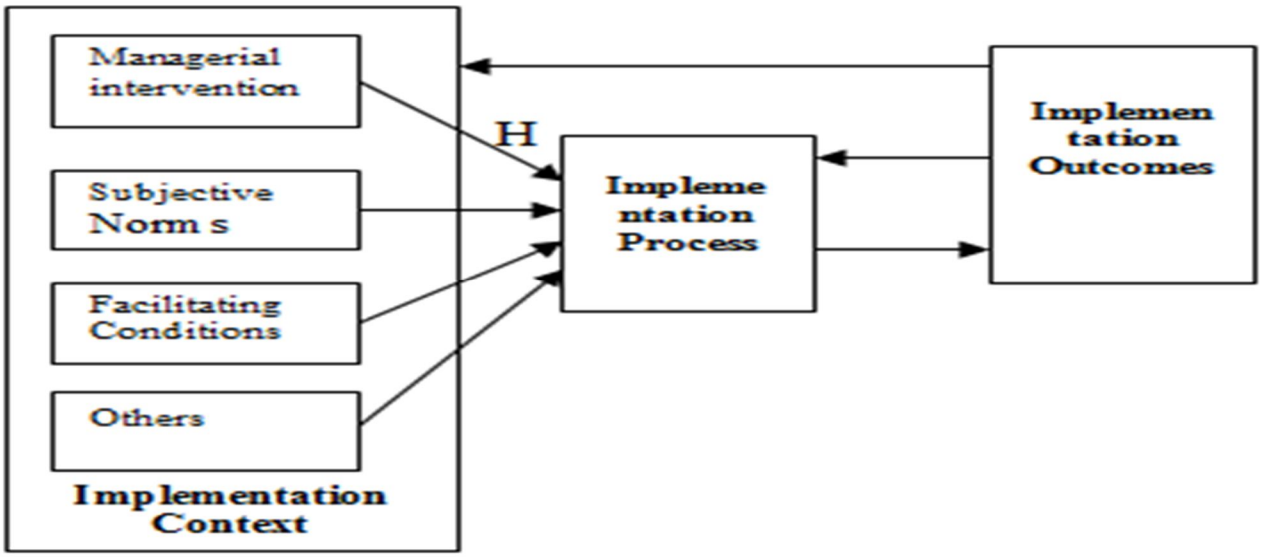

Figure 2 Conceptual Framework [Wambugu, 2012]

3. METHODOLOGY

This study mainly constituted quantitative research though there were also some aspects of qualitative analysis. Creswell & Miller (2000) says that qualitative researchers can use a lens based on the researcher's viewpoint or the participants viewpoint. A third lens may be the credibility of an account by individuals external to the study. Reviewers not affiliated with the project may help establish validity as well as various readers for whom the account is written.

The total population consisted of registered HEIs in Kenya. The target population included IS implementation representatives and practitioners in selected HEIs within Kenya that have undertaken implementation of IS. The source of data was the key personnel in management, Incharge of implementation, head of ICT, specialists in the implementation process, technicians and users.

Judgmental sampling was used to obtain HEIs which have adopted IS and have finished implementation process or are in the process to consist elements in the sample. The researcher established an informal relationship with key personnel to establish if the HEI had started or completed IS implementation and decided therefore whether to include the HEI in the sample or not. Convenient sampling was used in the study to obtain easily accessible samples.

This study gathered information using a self administered questionnaire which covered all the aspects of the framework. Individuals were asked to indicate the extent of agreement or disagreement with various statements concerning the OIISI framework on a seven-point Likerttype scale ranging from (1) strongly disagree to (7) strongly agree for various factors in the implementation process. Before the questionnaire was given to the respondents, a trial test was administered to three subjects. This was to confirm the instrument.

A Likert-type scale was preferred because it is easy to construct in comparison to Thurstone-type scale and can be performed without a panel of judges. Likert type is also considered more reliable because the respondents answer all indicated questions. It requires less time to construct and time was of essence here.

An interview schedule was used to personally interview senior management staff to gather qualitative data on opinions and to explain others variable in the Wausi(2009) framework. It was also used to confirm responses from the questionnaire. This ensured reliability and validity of collected data.

The hypothesized relationships among the study variables depicted in the framework were tested using confirmatory factor analysis (CFA) and correlation coefficients. The primary objective of a CFA is to determine the ability of a predefined factor model to fit an observed set of data, DeCoster(1998). CFA was used since the study involved validating an existing framework. It was used to determine regression coefficients which were interpreted accordingly. Correlation coefficients were used to determine the strength of the relationships hence test the hypothesis of the study and to calculate coefficient of determination which is used in statistical model analysis to assess how well a model explains and predicts future outcomes.

For purposes of research design, data presentation and data analysis, the following coding for variables was used:

MI - Managerial Intervention
MI.i - Managerial Intervention ith factor, where i=1, 2, 3,4,5,6 for MI.

IP - Implementation Process
IP.i - Implementation Process ith factor, where i=1,2,3,4,5,6,7 for IP.

RESULTS

Confirmatory Factor Analysis was used to determine if the number of factors and the loadings of measured (indicator) variables on them conform to what is expected on the basis of the framework

being tested. Apriori analysis was used to fit the data in the model/construct and interpret the results of the path coefficients.

To accomplish this task, a number of fit indices were used to give the goodness-of-fit indices of the model that best fits the data. The goodness of fit tests helps to determine if the model being tested should be accepted or rejected. The overall fit tests do not establish if particular paths within the model are significant. While there are no golden rules for assessment of model fit, reporting a variety of indices is necessary (Crowley and Fan 1997) because different indices reflect a different aspect of model fit. There is no single evaluation rule on which everyone agrees, Jeremy and Hun (2009). Hu and Bentler (1999) provide rules of thumb for deciding which statistics to report and choosing cut-off values for declaring significance. Jaccard and Wan (1996 87) recommend use of at least three fit tests. Suki and Ramayah(2011) in their paper titled Modelling Customer's Attitude Towards E-Government Services and available at http://www.waset.org/journals/ijhss/v6/v6-1-4.pdf on page 20 and 21 identifies the benchmark criteria for model fit summary statistics as follows:

Table 3: Model Fit Summary for Research Model

Fit Indices	Recommended Value
Absolute fit measures	
CMIN (χ2)/DF	< 3
GFI (Goodness of Fit Index)	> 0.9
RMSEA (Root Mean Square Error of Approximation)	<= 0.08
Incremental fit measures	
AGFI (Adjusted Goodness of Fit Index)	> 0.80
NFI (Normed Fit Index)	>= 0.90
CFI (Comparative Fit Index)	> 0.90
IFI (Incremental Fit Index)	> 0.90
RFI (Relative Fit Index)	0.90
Parsimony fit measures	
PCFI (Parsimony Comparative of Fit Index)	0.50
PNFI (Parsimony Normed Fit Index)	0.50

Below is a discussion of the goodness of fit statistics used to validate the indices obtained from the model.

Model chi-square, (CMIN).

This is also called the Discrepancy or the discrepancy function. The chi-square should not be significant if there is a good model fit, while the reverse is true. Relative chi-square is the chi-square fit index divided by the degrees of freedom i.e CMIN/DF. (Carmines and McIver, 1981; 80), state that the relative chi-square should be in the 2:1 or 3:1 for an acceptable model. (Kline, 1998) says 3 or less is acceptable

Goodness-of-fit Index, GFI

This deals with the error in reproducing the variance-covariance matrix. By convention, GFI should be greater or equal to 0.80 to accept a model.

Comparative Fit Index, CFI

This is also known as the Bentler Comparative fit Index. This compares the existing model fit with the null model which assumes that the latent variables in the model are uncorrelated.

Conventionally. CFI should be equal to or greater than 0.80 to accept the model, indicating that 80% of the covariation in the data can be reproduced by the given model.

Root Mean Square Error of Approximation, RMSEA

This is the discrepancy per degree of freedom. By convention, there is good model if RMSEA is less than or equal to 0.05. There is adequate fit if the RMSEA is less than or equal to 0.8. (Hu and Bentler 1999) have suggested RMSEA <=0.6 as the cutoff for a good model fit.

RMSEA does not require comparison with null model and thus does not require the author to posit as plausible a model in which there is complete independence of the latent variables as does, CFI.

Fully Identified Model (FIM)

To simplify the diagram from AMOS(v.18) for easier readability, a design diagram was adopted and only paths of interest indicated. The diagram below shows the standardized regression coefficient between Managerial Intervention and Implementation process.

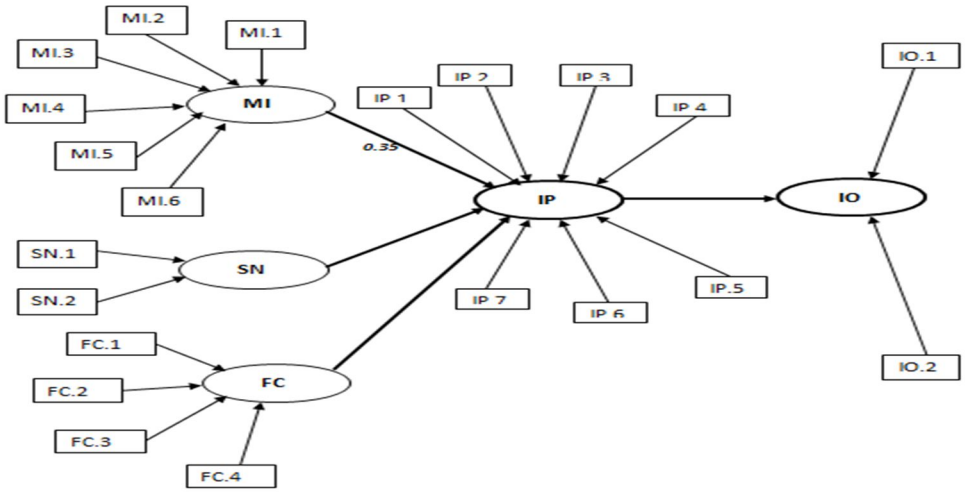

Figure 3: Standardized Regression Coefficient for the FIM [Source: Wambugu, 2012]

Table 4: Model fit Summary for the fully identified model

Fit Indices	Recommended Value	Model Results
Absolute fit measures		
CMIN		214.057
DF		162
P Value		0.004
CMIN ($\chi 2$)/DF	< 3	1.321
GFI (Goodness of Fit Index)	> 0.9	0.732
RMSEA (Root Mean Square Error of Approximation)	<= 0.10	0.08
Incremental fit measures		
AGFI (Adjusted Goodness of Fit Index)	> 0.80	0.618
NFI (Normed Fit Index)	>= 0.90	0.683
CFI (Comparative Fit Index)	>= 0.90	0.888 = 0.9 (2 dp)

IFI (Incremental Fit Index)	>= 0.90	0.899 = 0.9 (2 dp)
RFI (Relative Fit Index)	>= 0.90	0.589
Parsimony fit measures		
PCFI (Parsimony Comparative of Fit Index)	>= 0.50	0.685
PNFI (Parsimony Normed Fit Index)	>= 0.50	0.527

The X2 =214.06 which evaluated through 162 degrees of freedom is significant with a p-value=0.004, thus we do not reject the null hypothesis that the above construct will fit the data.
The Modification Indices, showed that no further covariances (for the residual terms/errors), no further variances and regression weights within observed variables.
Correlation Coefficient and Coefficient of determination
Correlation Coefficient is one of the most common and most useful statistics. A correlation is a single number that describes the degree of relationship between two variables and is used for purposes of testing hypothesis in this study.
The results of Pearson's Correlation coefficient as obtained from SPSS(v11.5) between MI and IP with MI as the independent variable is 0.6. It follows that the coefficient of determination is 0.36.

4. Analysis and Interpretation

Assuming a perfect linear regression, the CFA findings can be interpreted as follows:

$$IP = 0.35MI + b_0$$

That is $\frac{dIP}{dMI} = 0.35$
This means that a unit change in the independent variable (MI) causes a change of 0.35 in the dependent variable (IP).
Interpretation of Correlation Coefficients
According to MathBits.com(2000-2012) http://www.mathbits.com/mathbits/tisection/statistics2/correlation.htm visited on 4th March 2012, the value of r is such that -1 < r < +1. The + and – signs are used for positive linear correlations and negative linear correlations, respectively.
Positive correlation: If x and y have a strong positive linear correlation, r is close to +1. An r value of exactly +1 indicates a perfect positive fit. Positive values indicate a relationship between x and y variables such that as values for x increases, values for y also increase.
Negative correlation: If x and y have a strong negative linear correlation, r is close to -1. An r value of exactly -1 indicates a perfect negative fit. Negative values indicate a relationship between x and y such that as values for x increase, values for y decrease. No correlation: If there is no linear correlation or a weak linear correlation, r is close to 0. A value near zero means that there is a random, nonlinear relationship between the two variables
The reference further notes that r is a dimensionless quantity; that is, it does not depend on the units employed. A perfect correlation of ± 1 occurs only when the data points all lie exactly on a straight line. If r = +1, the slope of this line is positive. If r = -1, the slope of this line is negative.
This criterion can be summarized in the table below:

Table 5: Interpretation of Correlation Coefficients

Range of coefficient(r)	Interpretation
1.0	Perfect positive correlation
0.5 < r < 1.0	High positive correlation
0 < r < 0.5	Low positive correlation
0	No correlation
0 > r > - 0.5	Low negative correlation
-0.5 > r > -1.0	High negative correlation
-1.0	Perfect negative correlation

Interpretation of Coefficient of determination

According to MathBits.com (2000-2012) http://www. mathbits.com/mathbits/tisection/statistics2/correlation.htm, coefficient of determination is a measure used in statistical model analysis to assess how well a model explains and predicts future outcomes. It is indicative of the level of explained variablity in the model. The measure gives the proportion of the variance (fluctuation) of one variable that is predictable from the other variable. It is a measure that allows us to determine how certain one can be in making predictions from a certain model/graph. The coefficient of determination is the ratio of the explained variation to the total variation. The coefficient of determination is such that $0 < r\ 2 < 1$, and denotes the strength of the linear association between x and y.

The results above indicate that the coefficient of determination between MI and IP is 0.36. This means that 36% of the variation in Implementation Process can be explained by Managerial Intervention.

Results of Hypothesis Test

From the values of correlation coefficients, results are as follows:

H1: The results indicate a Correlation coefficient of 0.6 between Managerial Intervention and Implementation Process which is positive and significant at the 0.01 level. We therefore reject the null hypothesis that there is no relationship between Managerial Intervention and Implementation Process.

5. Conclusion

The results indicate that a relationship exists between MI and IP according to the constructs of the OIISI framework. The relationship has been described in the study by use of standardized regression coefficient, Pearson's correlation coefficient and the coefficient of determination as follows: That a unit change in MI causes a change of 0.35 in IP, a Correlation coefficient of 0.6 between Managerial Intervention and Implementation Process which is positive and significant at the 0.01 level enables us to reject the null hypothesis that there is no relationship between Managerial Intervention and Implementation Process and 36% of the variation in Implementation Process can be explained by Managerial Intervention. The construct therefore is an important component of the framework.

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