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## EVALUATION OF EFFECTIVENESS OF ERP IN A DAIRY INDUSTRY—A CASE STUDY

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### Abstract

Organizations look to enterprise resource planning (ERP) as a significant strategic tool. But in practice there are many difficulties in its implementation. In this study, an attempt has been made to evaluate the effectiveness of ERP implementation. A case study was conducted at Verka Ludhiana Dairy (VLD), a unit of Milkfed Punjab. A questionnaire survey was conducted on the basis of 12 key success indicators (KSI). Statistical tools were used to analyze the data gathered through questionnaire to identify the effect of various independent variables. The study revealed that the factors like Top management support and Data sharing between the different departments of VLD is most significant out of these 12 key success indicators. It has been observed that the qualification or the educational level of the employees is one of the most critical independent variable which is lacking there. Finally It was concluded that the existing ERP structure in stated organization is not purposeful enough for quick and effective decision making.

**Keywords:** ERP,

### I. INTRODUCTION

Enterprise resource planning (ERP) in the industry is the term used to describe a broad set of activities supported by multi-module application software that helps a manufacturer or other business manage the important parts of its business. These parts include product planning, parts purchasing, maintaining inventories, interacting with suppliers, providing customer service, tracking orders etc. ERP can also include application modules for the finance and human resources aspects of a business. ERP is a fully integrated business management system covering logistics (materials, production, sales and distribution, plant maintenance, quality management, project management, production planning etc.), Accounting (finance and controlling and human resources etc.) .It supports a process-oriented view of the business as well as business processes standardized across the enterprise. Among the most important attributes of ERP are its abilities to: automate and integrate an organization's business processes; share common data and practices across the entire enterprise; and produce and access information in a real-time environment.

Literature review revealed that the concept of ERP has been implemented in many industries all-around the world and in India as well. But the success rate of ERP implementation is rare and fragmented. Moreover, only few studies have been made towards the effectiveness of the ERP implementation. From the literature it has been concluded that fields like FMCG sectors or Food processing industries are those to which effectiveness of ERP implementation is not tested yet. So it is high time to make a study about the effectiveness of ERP implementation where ERP concept has already implemented and to know the level of effectiveness. Hence the need is felt to identify the key success indicators to know the effectiveness of ERP system in VLD and to know the impact of effectiveness on the industry.

. The objectives of study include:

1. To evaluate the effectiveness of ERP in VLD.

2. To identify the factors which resist effectiveness of implemented ERP in VLD.

To identify the independent variable/parameter which affect the effectiveness of ERP in VLD with respect to key success indicators.

### II LITERATURE REVIEW

**Davenport (1998)** conducted a research on motivation factors for adopting ERP systems by the industries, there are many reasons for implementing enterprise solutions. Some of the factors identified in his study were; the provision of a single source of data, the potential cost reduction and potential gain in business integration. **Stedman (1999)** studied profits of the Hershey foods corporation. It was concluded that a 19% drop in the 3<sup>rd</sup> – quarter profits and a 29% increase in inventories over the previous year due to order processing problems caused by its \$112 million ERP implementation. **Gilbert (1999)** conducted a research on two case companies, Miller industries and WW Grainger Inc. Miller industries reported a \$3.5 million operating loss in the 4<sup>th</sup> quarter of 1999 due to the cost and inefficiencies of its ERP system. WW Grainger Inc. reported an \$ 11 million reduction in operating earnings from its improper ERP implementation. **Stedman (1999)** highlighted that McKesson HBOC has reported a successful implementation of its \$1.5 million ERP back-office system that now process sales order totaling 1.5 million line items and \$100 million of business each day. **Wah (2000)** reported that Casebook water and power technologies, an \$30 million manufacturer of water purification systems has seen improvements in materials management, project management, and employee productivity due to its ERP system. **Singla and Goyal (2006)** observed that ERP systems prove to be a failure either in the design or its implementation. A number of reasons contribute in the success or failure of an ERP systems. Enterprise resource planning systems inherently present unique risks due to tightly linked interdependencies of business processes, related databases, and process reengineering, etc. Knowledge of such risks is important in

design of system and program management as they contribute to success of overall system. In this paper an attempt has been made to study the design and implementation risks factors for ERP systems in Indian organizations. For this two public sector companies namely PUNCOM and PTL located in northern India have been selected. Based on the model used to study ERP risks and thus the findings, various recommendations have been put forward to suggest a strategy so as to mitigate and manage

such risks. **Bueno and Salmeron (2008)** focused on decisive factors influencing the ERP users' acceptance and use. Specifically, the authors have developed a research model based on the Technology Acceptance Model (TAM) for testing the influence of the Critical Success Factors (CSFs) on ERP implementation. The CSFs used are: (1) top management support, (2) communication, (3) cooperation, (4) training and (5) technological complexity. It has been found that, first, organizations would have to involve potential users in the main stages of the ERP implantation project with the intention of reaching a successful implementation. Specifically, organizations would select an ERP with little complexity, considering factors such as the educational level of the users and their organizational culture. Secondly, training can be considered to be the main action for reducing the perception of an ERP system's complexity. Thirdly, top management support becomes a key factor for an organization to implement an ERP system successfully. **Hasan et al. (2011)** described that the planned and actual use of ERP systems is pervasive in the Australian manufacturing sector, with both small and large companies implementing or planning to implement an ERP system. It was also revealed that ERP system implementation benefits are concentrated more in quickly providing high-quality information within firm. A questionnaire survey is conducted, research frame is selected from the Australian manufacturing sector and a final list of 350 Australian manufacturing companies was prepared from which 79 responses were received, representing a response rate of 23 per cent. **Dezdar and Ainin (2011)** examined organizational factors (i.e. top management support, training and education, enterprise-wide communication) that may influence the Enterprise Resource Planning system implementation success in Iran suggested that the company's top management must provide full support and commitment to the project if the system is to be successful. In addition, the management must also ensure the plans are communicated and understood by the entire company. Finally it was also illustrated that adequate training and education pertaining to the systems must be given to all the users to ensure that they are able to use the system effectively and efficiently thus contributing to their satisfaction which will subsequently influence the implementation success.

## II.METHODOLOGY

In this research work, the data was analyzed by making use of chosen statistical analysis tools viz. Z-Test and Chi-square ( $\chi^2$ ) test.

**Z-Test:** Z-Test is based on the normal probability distribution and is used for judging the significance of several statistical measures, particularly the mean. The relevant test static, z, is worked out and compared with its probable value (to be read from the table) at a specified level of significance of the

measure concerned.

**Chi-square ( $\chi^2$ ) test:** Chi-square ( $\chi^2$ ) test is based on Chi square distribution and as a parametric test is used for comparing a sample variance to a theoretical population variance. Such a distribution we encounter when we deal with collections of values that involve adding up squares. The  $\chi^2$  distribution is not symmetrical and all the values are positive. For making use of this distribution, one is required to know the degrees of freedom. The smaller the number of degree of freedom, the more skewed is the distribution.

After the collection of data from the selected population, two basic measurement techniques were used. These techniques were important for the application of statistical tools used. These techniques were: Scaling and Grading.

Hypothesis testing determines the validity of the assumption taken by the researcher after the problem formulation. Parametric tests like Z-test and Chi-square ( $\chi^2$ ) test were used to analyze the data. For judging the significance of the difference between means of two independent samples we have Z-test and T-test. But T-test is used only for small sample sizes (less than 30). So we used Z-test. Z-test was used to test the significance of difference in the mean scores. If the calculated value of  $|z| \geq z_{0.05}$ , the difference between the sample means is said to be significant at 5% level of significance, otherwise the data are said to be consistent with the results.

The following methodology needed to be adopted for execution of the research work.

1. Identification of key success indicators arbitrarily.
2. Segregation of different levels of management for effective data collection.
3. Pilot testing has been done for preparing questionnaire.
4. Distribution of questionnaire to the selected population.
5. Data collection questionnaire for top and middle level management.
6. Preparation of schedule for lower level management.
7. Observation has been done.
8. Analysis of data.

### Selection of Population:

The population consists of all the employees who are employed in VLD. The population is than Segregated in different levels of Management for effective Data Collection. These different Levels of Management are segregated as Top Management level (Managers).Middle Management level (Dy. Managers) and Lower Management level (Trainees and Plant Staff).Total questionnaires Distributor: 72, Received: 52, Response Rate: 72.22%.The questions had twelve Critical success factors (key success indicators) namely: ERP Team Work and Composition, Top Management Support, Effective Communication, Software Development, Testing and Troubleshooting, Data Sharing, Business Plan and vision, System Reliability, System Flexibility, Total Cost, Technical Ability, Awareness, Monitoring and Evaluation of Performance. All these factors are the factors related to the effectiveness of ERP in VLD

### Description of questionnaire

In questionnaire, each of the key success indicator is addressed through six statements to which the respondents is asked to react using a five step Likert-scale of 'strongly-disagree', 'disagree', 'neutral', 'agree' & 'strongly agree'. Some of the items are crafted in a positive sense (ERP team of MPL is very effective), some are crafted in negative sense (Communication between the departments is not satisfactory) & the rest of the items are crafted in interrogative sense (Do the top management has full knowledge for the success of ERP.). Assigning a value of 1 to “strongly disagree” and 5 (1×5) to “strongly agree” means that, with five questions per factor, the minimum value is 25 (5×5), with a minimum of 15. Therefore value up to 15 indicates that the concerned person is satisfied. By compiling the data for each of twelve factors, it becomes apparent which dimensions are effective and which are ineffective. To gauge a respondent's overall satisfaction the minimum value of the score possible is 36 (36×1) and maximum of 180 (36×5), with a mean of 108. Therefore value up to 108 indicates that the respondent is overall dissatisfied and a score of above 108 indicate that the respondent is overall satisfied.

**Pilot- Testing**

Pilot testing helps in framing the effective questionnaire for the study and for the effective results of the study. Firstly the questions were designed after taking the observations from the different departments of VDL. These questions are then checked by expert and correction was done for effective questionnaire. Next and final step is to design the individual data sheet after considering the old questions and the corrections made by the experts.

**Distribution of questionnaire and Data Collection**

The questionnaire was distributed to the selected population by hand to hand in the MPL. Each department is visited and the questionnaire is distributed to the members individually. There are some employees (lower level management) which are not so much educated for answering those questions. Scheduling for the lower level management staff was prepared for easy and smooth answering of the questions.

**Research hypothesis**

H1:Key success indicators are not responsible for the effectiveness of ERP in MPL.

H2: The Independent variables/parameters has no impact on key success indicators to determine the effectiveness.

**III. RESULT & DISCUSSION**

In this research scaling and grading techniques that were utilized to assess the effectiveness of ERP in VLD. The scaling was done on the basis of the score of the respondents assigned to each question according to five step Likert scale. Scaling describes the procedure of assigning numbers to various degrees of opinion, attitude and other concepts. After the collection of data the scores of each employee was analyzed. If

an employee scores one on Likert scale three times (3×1), scores two onetime (1×2), scores three seven times (7×3), scores four ten times (10×4) and scores five fifteen times (15×5). After summation of the scores the total overall score of individual employee is 141. To gauge a respondent's overall satisfaction the minimum value of score possible is 36 (36×1) and maximum of 180 (36×5), with a mean of 108 Therefore values up to 108 indicates the respondent is overall dissatisfied by the existing ERP system and a overall score of above 108 indicate that the respondent is overall satisfied by existing ERP system of MPL. Figure 3.1 shows the status of satisfaction of employee and table 3.1 shows the total overall score of the employees on Likert scale



The other technique used for assessing the effectiveness of ERP in VLD was grading. Grading is the process used to find out that to which attribute the employees of VLD gives more weight age and to which less weight age of scores. If an employee scores 4 for question one, scores 5 for question thirteen and scores 3 for question twenty five (for the same attribute), then the total score for that attribute is 12(4+5+3). To gauge a respondent's overall satisfaction the minimum value of score possible is 3 (if the respondent score 1 to all three questions of same attribute) and maximum of 15 (if the respondent score 5 to all three questions of same attribute), with a mean of 9. Therefore, values up to 9 indicate the respondent is overall dissatisfied by that attribute and a overall score of above 9 indicate that the respondent is overall satisfied by that attribute. Table shows the grading scores of the 52 respondents with respect to each of the twelve key success indicators.

**KEY SUCCESS INDICATORS SCORES FOR THE EFFECTIVENESS OF ERP IN VLD**

Table 1: Represents the scores of the employees (Mean ± SD) for all the twelve dimensions for both effective and ineffective group

**Table 1: Scores of factors determining the effectiveness**

S. NO.	VARIABLE	MEAN	STD. DEVIATION	Z-TEST (P VALUE)
1.	ERP Team Work and Composition (ETWC)	9.59	2.13	0.022 NHR
2.	Top Management Support (TMS)	10.53	1.39	7.77E-16 NHR
3.	Effective Communication (EC)	11.09	1.27	0.0001 NHR
4.	Software Development , Testing and Troubleshooting (SDTT)	10.75	1.41	0.0001 NHR
5.	Data Sharing (DS)	10.34	1.41	3.16891E-12 NHR
6.	Business Plan and vision (BPV)	12.92	0.96	0.0001 NHR
7.	System Reliability (SR)	10.75	1.37	0.0001 NHR
8.	System Flexibility (SF)	12.26	1.95	0.0001 NHR
9.	Total Cost (TC)	13.34	1.42	0.0001 NHR
10.	Technical Ability (TA)	13.90	1.38	0.0001 NHR
11.	Awareness (A)	13.48	1.89	0.0001 NHR
12.	Monitoring and Evaluation of Performance (MEP)	12	1.31	0.0001 NHR

\* Significant at 5% level of significance

It has been found that in all the twelve dimensions of the effectiveness there was a significant difference between mean scores at 5% level of significance. If P- value is less than the level of significance (which is 5%) then the results are significant. From the above results it is clear that the P-values of all the key success indicators are significant for 5% level of significance. After applying Z- test it has been observed that the factors like Top management support and Data sharing between the different departments of MPL is most significant out of these 12 key success indicators.

**SEGREGATION OF EFFECTIVE AND INEFFECTIVE RESPONSES OF THE RESPONDENTS**

From the grading scores it has been found that if the score of the respondents is up to 9, then the scores were taken as ineffective or not effective and if the scores of the respondents is above 9, then the scores were taken as effective. Table 2 gives the percentage distribution of employees among two groups.

**Table 2: Dimension wise distribution of employees**

NO	AREA	NOT EFFECTIVE (%AGE)	EFFECTIVE (%AGE)
1.	ERP Team Work and Composition (ETWC)	16(30.76)	36(69.23)
2.	Top Management Support (TMS)	3(5.76)	49(94.23)
3.	Effective Communication (EC)	2(3.84)	50(96.15)
4.	Software Devebpmnt , Testing and Troubleshooting (SDTT)	3(5.76)	49(94.23)
5.	Data Sharing (DS)	2(3.84)	50(96.15)
6.	Business Plan and vision (BPV)	0(0)	52(100)
7.	System Reliability (SR)	3(5.76)	49(94.23)
8.	System Flexibility (SF)	4(7.69)	48(92.30)
9.	Total Cost (TC)	0(0)	52(100)
10.	Technical Ability (TA)	0(0)	52(100)
11.	Awareness (A)	1(1.92)	51(98.07)
12.	Monitoring and Evaluation of Performance (MEP)	0(0)	52(100)

**EFFECT OF VARIOUS INDEPENDENT VARIABLE/ PARAMETERS ON ERPTEAM WORK & COMPOSITION**

Table 3 represents the effect of various independent variables /parameters on account of ERP team work and composition. Out of 52 responses 36 were effective with respect to ERP team work and composition and 16 were not effective. After applying Chi-square ( $\chi^2$ ) test the  $\chi^2$  (calculated) is compared with  $\chi^2$  (tabulated) to compare the variance at 5% level of significance.

Table 3: Effect of various independent variables on ERP Team work and Composition

Variables	Total (52)	Not Effective (16)	Effective (36)	$\chi^2$ Cal	$\chi^2$ Tab	
Qlf	10+2 or Below	19	6	13	0.2 NHA	5.9 91
Educa-tional	Graduate P.G & Above	17	6	11		
Exper-ience	Above 16	5	11	0.108 NHA	5.9 91	
	5-10 Yrs	5	3			
	Above 10 Yrs	31	9			22

Designation	Top Level	8	3	5	0.34 NHA	5.9 91
	Middle Level & Tech. ERP Team	13	2	11		
	Lower Level & Trainees	31	11	20		
Category	Technical	14	3	11	3.0 NHA	5.9 91
	Professional	10	1	9		
	Neither Tech. Nor Professional	28	12	16		

Designation	Top Level	8	0	8	0.03 NHA	5.991
	Middle Level & Tech. ERP Team	13	2	11		
	Lower Level & Trainees	31	1	30		
Category	Technical	14	1	13	1.92 NHA	5.991
	Professional	10	0	10		
	Neither Tech. Nor Professional	28	2	26		

**NHA- NULL HYPOTHESIS ACCEPTED**

The parameters, qualification level of employees of MPL, experience, category and designation do not affect the effectiveness of ERP in MPL with respect to ERP team work and composition.

**EFFECT OF VARIOUS INDEPENDENT VARIABLES ON TOP MANAGEMENT SUPPORT**

Table 4 represents the effect of various independent variables /parameters on account of Top Management Support. Out of 52 responses 49 were effective with respect to Top Management Support and 3 were not effective. After applying Chi-square ( $\chi^2$ ) test the  $\chi^2$  (calculated) is compared with  $\chi^2$  (tabulated) to compare the variance at 5% level of significance.

**Table 4 : Effect of various independent variables on Top Management Support.**

Variables		Total (52)	Not Effective (3)	Effective (49)	$\chi^2$ Cal	$\chi^2$ Tab
Qualification or Educational Level	10+2 or Below	19	0	19	11.60 NHR	5.991
	Graduate	17	1	16		
	P.G & Above	16	2	14		
Experience	0-5 Yrs	16	1	15	0.15 NHA	5.991
	5-10 Yrs	5	1	4		
	Above 10 Yrs	31	1	30		

It is found that the qualification level of employees of MPL affect the effectiveness of ERP in MPL with respect to Top management support. Thus effectiveness of ERP with respect to Top management support was affected by qualification or educational level of employees, but had no effect by any other independent variable.

Similar way effect of various independent variables on effective communication, software development testing & trouble shooting, on business plan & vision, on data sharing, on system reliability, on system flexibility, on total cost, on technical ability, on awareness and finally on monitoring & evaluation of performance done.

It has been observed that the qualification or the educational level of the employees is one of the most critical independent variable which is lacking in VLD. To achieve efficient ERP system the qualification or educational level of the employee of VLD may be improve accordingly.

**IV. CONCLUSION**

The study identifies 12 key success indicators of which all were identified as the critical but the factors like Top management support and Data sharing between the different departments of Verka Ludhiana Dairy is most significant for the effectiveness of ERP in the case company. In all the twelve factors viz. ERP Team Work and Composition, Top Management Support, Effective Communication, Software Development, Testing and Troubleshooting, Data Sharing, Business Plan and vision, System Reliability, System Flexibility, Total Cost, Technical Ability, Awareness, Monitoring and Evaluation of Performance, there was significant difference at 5% level of significance. That means variation in scores was not because of sampling fluctuation. Among all the twelve factors ERP Team Work and Composition was the only factor to see maximum number of ineffective responses (30.76%). Among all the twelve - Business Plan and vision, Total Cost, Technical Ability, Monitoring and Evaluation of Performance were the only four factors to see

maximum number of effective responses (100%). The findings show that the independent variables like qualification or educational level of the employees affects the effectiveness of ERP in Verka Ludhiana Dairy. The existing ERP structure in the organization is not purposeful enough for quick and effective decision making.

#### FUTURE SCOPE

In this study only 12 key success indicators are taken. It is required to apply the study taking other factors or indicators into account. In this research work the case company is a milk producing industry. The same study can also be used by other FMCG industries. Also Cost related factors may be studied and Individual department wise ERP implementation success factors may be studied.

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