

# Tracking the Flow of Knowledge in IT organizations; The Impact of Organizational Learning Factors and Project Learning Practices on Project Success

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## Abstract

*Knowledge exists at both the organizational and unit levels; environment factors at either level may enable or impede knowledge sharing within an IT organization. There is, however, no meaningful means to measure organizational or unit level knowledge sharing. The need to understand this flow of knowledge within an organization is dramatically evidenced in information technology organizations in which insufficient knowledge sharing leads to intellectual capital loss, rework, skills deterioration, and repeated mistakes that increase project costs leading to failure. The goal of the current study was to examine the relationship among knowledge sharing processes at the organizational level – organizational learning factors – the unit level – project learning practices – and the success of the IT project.*

*Twelve organizational learning factors, eleven project learning practices, and nine project success variables were identified and validated through an expert panel review. These constructs were then codified in a survey and distributed to 5,000 IT managers. This study found a positive and significant relationship among organizational learning, project learning, and project success in IT organizations.*

## 1. Introduction

Knowledge assets exist at the organizational, group or unit, and individual layers [12]. This multi-level concept can be extended to the organizational and project layers [44] for project-based organizations [1, 31]. Thus, projects may serve as the lab to evaluate knowledge at the unit and organizational level within an IT organization.

When knowledge does not flow among project teams within an IT organization resources are wasted. New project teams ‘reinvent the wheel’ as opposed to learning from prior projects [43]. Some projects repeat errors for years because learning from previous

projects did not happen [1]. Furthermore, companies experience waste in the form of lost potential to build employee skills [58]. Thus, when project teams do not share lessons learned, poor solutions are duplicated, mistakes repeated, and knowledge of good procedures lost, leading to rework and missed opportunities [46, 48].

Organization managers generally do not make it a priority to share lessons learned between project teams. Managers may not understand the value derived from sharing lessons among project teams. For example, a knowledge manager faced a challenge convincing senior management on the value of KM. “My bosses want to see how KM implementation improves the ROI [return on investment] of the company, and how am I going to convince them since it is hard to measure KM using dollars and cents?” [8, p. 930].

One answer to the problem of lost knowledge is to better understand the barriers to the flow of knowledge at various corporate levels, from organizational to project, and the impact of that flow on project success. If a positive relationship exists among organizational-level and project-level learning factors and project success, then a better understanding of the value of promoting organizational learning initiatives and project learning practices within IT organizations would ensue.

The importance of this research stems from the struggles Information Technology (IT) organizations have experienced in delivering successful projects for decades. Projects continue to fail for many of the same reasons that they did 30 years ago [7]. These failures lead to economic consequences. For example, companies spent millions of dollars on failed ERP implementations [59]. In the United States, the cost of failed IT projects amounts to \$63 billion [40].

In a very meaningful sense, “these dismal findings can be traced to poor organizational learning mechanisms in software organizations” [13, p. 204]. Project teams were not learning lessons from other teams and this contributed to higher project costs [22]. Lack of knowledge was the key reason that IT projects

fail [41]. Thus, this research was focused on measuring factors that enable the flow of knowledge among IT project teams and the relationship of the flow with project success.

Knowledge Management (KM) creates value out of intangible assets [36] by enabling an organization to capture, store, transfer and retrieve knowledge, ensuring effective utilization [2] in order to provide people with understanding of why, how, and what to accomplish [14].

Project management entails the knowledge and specific skills to realize business value from projects [49, 53]. Projects as temporary organizations are established to achieve certain objectives. Projects are unique because they bring together people from multiple functions to work outside of normal routines [22]. Project work is also often unpredictable and complex [53].

Primary functions of the project manager include management of knowledge within the team and with other teams to achieve success [50]. The program executive at the enterprise level facilitates enterprise-wide knowledge sharing, knowledge reuse, training, benchmarking, and capturing lessons [45]. Thus, KM within project-based organization is a specialized area that entails learning at the organizational and project layers within project-based entities.

Knowledge frequently does not flow among project teams [1, 43, 46, 48, 58]. Organizational failures to extract and apply project lessons learned are widespread [42]. Since knowledge exists at both the organizational and project levels, barriers to knowledge flow can exist at the organizational or project level [1, 12, 31, 44]. Meaningful means to measure organizational or project level knowledge sharing do not appear to exist.

Organizational learning factors relate to the systems and processes that facilitate individual learning. Organizations can impede or promote learning [31]. Organizational policies can cause project teams to focus more on applying historical information rather than first understanding the relevance of the lessons for the emerging project [21]. The organization's culture, systems and procedures, as well as IT, enable knowledge transfer between projects [30]. Senior management support for an organizational KM system enables project management success [62]. Thus, Organizational Learning Factors (OLFs) such as culture, systems, tools, policies, and leadership impact for better or worse the relationship between project learning and project success.

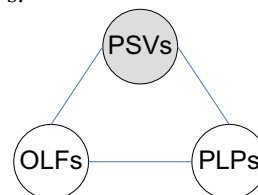
Lessons learned as knowledge gained from experience are important and relevant [18]. For example, the Space Project Management Lessons Learned initiative enabled organizations to plan and

manage future projects better. Project lessons came from previous or current projects and support improvement in future project management [18]. "Project learning practices involve each project undertaking regular project reviews and maintaining project documentation" [42, p. 569]. The value of post-project reviews comes from the flow of lessons learned to future projects and the organization [4]. Post-project reviews provide a structured means to capture lessons learned for the benefit of future project teams [58]. The combination of these ideas suggests a concept that can be labeled Project Learning Practices (PLPs). PLPs are the project processes and activities that mature teams conduct to capture, store, and transfer lessons learned, and emerging project teams conduct to access, evaluate, and decide which lessons to apply.

Projects can be evaluated based on meeting schedule and delivering within budget [3, 4, 30, 54]. One may measure project efficiency based on evaluating cost and time performance [54]. Project success may also be evaluated based on the quality of the product in that it meets stated requirements, contains few defects, is maintainable [6, 47, 49], and demonstrates quality in the form of conformance to requirements, effective communication of requirements, and delivery without defects [47]. The Project Management Institute (PMI) relates quality to the degree that the product delivers to specifications. Project Success has also been gauged based on user satisfaction [4, 54] and on the business benefits delivered. Business benefits can refer to financial returns, market position and impact on growth [54]. These project success variables (PSVs) are indicators of project success.

The goal of this research was to explore the flow of knowledge within an organization by: 1) identifying those factors at the organizational level that impact knowledge sharing; 2) identifying those factors at the unit or project team level that impact knowledge sharing; and 3) establishing the impact of those factors have on a tangible measure of successful transfer of knowledge, in this case project success.

The theoretical framework (depicted in Figure 1) is based on the expected interaction of the OLFs, PLPs, and PSVs.



**Figure 1. Theoretical framework – Relationship among OLFs, PLPs, and PSVs**

The goal and theoretical framework outlines the relationship between OLFs, PLPs, and PSVs led to three research questions as follows:

- 1) What constitutes OLFs, PLPs, and PSVs?
- 2) What relationships exist in IT organizations among OLFs, PLPs, and PSVs
- 3) What portion of project success can be attributed to OLFs and PLPs?

## 2. Methodology

### 2.1 Content analysis

Using 63 peer reviewed KM articles, the OLFs, PLPs, and PSVs were formulated. A six-step process guided the analysis [11]. Data was organized and prepared (step 1); reviewed multiple times (step 2); analyzed and characterized (step 3); coded and described (step 4); charted and represented (step 5); and interpreted (step 6). This analysis identified the major ideas through synonyms and understanding of relationships with other terms [9]. Elements were categorized and the number of times concepts were mentioned was counted [24, 33]. In order to organize and prepare the data (step 1) a purposeful sample was conducted using databases in Table 1 [10]. A spreadsheet enabled the authors to record the identification, quotation, citation, and research type for each element. The recorded data was listed in three separate tables; one each for OLFs, PLPs, and PSVs.

**Table 1. Databases**

Database Name
ABI/Inform Complete-ProQuest
ACM Digital Library
IEEE Computer Society Digital Library
Computers and Applied Sciences Complete - EBSCO host
Academic OneFile - Gale Cengage Learning
Applied Science and Technology Full Text - Wilson Web
Emerald Management ejournals - Emerald Group
IBI Global Science Direct - Elsevier
Dissertations and Theses - ProQuest

Data included “sentences, paragraphs, or themes” [57, p. 79] that suggested useful organizational learning and project learning approaches. In addition, data was extracted that defined measures for project performance.

The protocol to capture the data (step 1 continued) involved taking short notes or quoting the sources using a table that captured the note or quote and a citation [11]. For each data element, the quote or short note and the citation (authors, year, and page) were captured. In this research most of the data consisted of direct quotes. Sometimes a short explanation

expanded on a quote or captured the essence of a concept. OLFs, PLPs, and PSVs, emerged from the captured data.

References to the culture, processes, systems, tools, policies, and leadership that affected organizational learning suggested an OLF. For example, "it is necessary for project-based organizations to develop an organizational culture that coordinates and facilitates knowledge transfer" [1] suggested an OLF. If an article referred to activities that emerging project teams conducted to access, evaluate, or decide which lessons to apply, a PLP was suggested. In addition, references to methods to capture, store, and transfer lessons learned also suggested a PLP. For example, “organizations that routinely schedule and hold post-project reviews can continually refine the conduct and improve the benefits of these exercises” [4]. If an author concluded that project success should be measured based on certain dimensions or metrics, a PSV was suggested. For example, "meeting customer expectations, final quality, and successful mitigation of all identified risks and threats to project completion" [4, p. 637].

The process step mentioned above was repeated (step 2) after two months by the authors. This work often validated the first review. However, during the second review there were times the authors added or deleted data. Also, the authors continually checked articles to ensure that the quote reflected the researcher’s context.

The authors analyzed and categorized the data (step 3) by iteratively developing a theme and then grouping data within a theme. For example, several researchers suggested that there be an environment of trust and support within an organization’s culture to facilitate knowledge sharing. This led to a single group designation labeled as “trusting and supportive culture.”

The authors assigned identification codes to each element (step 4). The coding process involved several iterations [10, 57]. For example, a data element could initially appear to be an OLF identified as OLF1. Upon reexamination, OLF1 could become a PLP with an id PLP5.

In this research, findings were represented in tables (step 5). Finally, the interpretation (step 6) led to groups of learning practices that were translated into survey questions.

### 2.2 Validating the survey via a Delphi team

In an experiment of 288 university students, researchers found that the Delphi technique produced higher quality decisions than the nominal group technique, interacting teams, and consensus groups [16]. Also, the Delphi technique has been used to

pretest the survey for KM research [23]. The Delphi method proved effective when time and distance separated the team members [60]. Thus, the Delphi technique was selected for this research.

The Delphi team development process consisted of three steps. First the goal was developed. Second, the team-member selection criteria were established and members were invited. Third, the team executed the process.

The Delphi team’s goal was to reach consensus that the survey would be an effective tool to answer the research question. Consensus was indicated by the statistical average including each team member’s response [60]. In this research, consensus that the survey was ready to distribute to the sample occurred when the mean for each question equaled four or better and no individual question score equaled two or less.

Before the Delphi team could begin its work, the qualifications for team membership and team size were established (Step 2). Four requirements qualified team members. First, the team members needed to have knowledge and experience related to the issue being researched [55]. Second, the team members had to be willing and capable of participating. Third, the team members had to have enough time to participate. Fourth, the team members should be effective communicators. In a similar study, people were selected with experience in KM, project management, and survey development [32]. The Project Management Institute’s requirements that certificate candidates must have three years experience also provided guidance for selection. [48]. Participants were invited after reviewing several criteria including knowledge management experience (at least three years), project management experience (at least three years), communication skills, academic and practical experience. Table 2 illustrates the criteria for participation and qualifications by presenting germane information for two participants. Ultimately, 10 candidates agreed to participate.

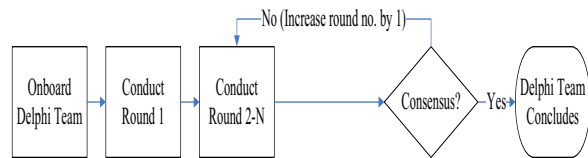
**Table 2. Criteria and examples for Delphi team**

Criteria	Alpha	Romeo
Knowledge / Experience	10 yrs. as IT PM	30 yrs. at senior IT level.
*KM (3 years)	Yes	Yes
*PM (3 years)	Yes	Yes
Communications	Excellent	Excellent
Academic	University grad.	University grad.
KM Experience	Developed a KM program.	Led KM development programs.
Decision level	Project	Organization
Synthesizer	Yes	Yes

With the start of step 3, the Delphi team transitioned from planning to execution. The authors contacted prospective team members and then sent a follow-up email and an informed consent form.

IT researchers outlined a Delphi technique that is the basis of the process used here [55]. Once the team was formed, the Delphi process was divided into rounds. The team never came together nor did they know who else was on the team [15]. In preparation for the first round, participants received a description of the research, a short description of the Delphi process, a draft survey and instructions, and finally a questionnaire about the survey. In round one, the participants were not asked to quantitatively rate the survey [28] but were asked if the survey instrument would appropriately measure OLFs, PLPs, and PSVs [32]. The Delphi team members identified and commented on how questions they deemed deficient may be improved. The Delphi team members returned the questionnaire about the survey to the researcher completing the first round.

Preparation for round 2 began after the questionnaire about the survey was returned. The researcher prepared a return comment matrix, a revised survey, and, starting with round 2, the questionnaire about the survey included quantitative ratings for each question in the survey. Each team member’s comment and the author’s reply were returned to the team [55]. Thus, individual participants could view the return to see that their comments were included and action taken. The researcher then sent the return comments, a revised survey, and the new questionnaire about the survey back to the Delphi team to commence round 2. Again, the Delphi team members provided feedback to the researcher. Rounds 3 and 4 followed a similar process. Figure 2 illustrates the Delphi team process.



**Figure 2. Delphi process**

The survey instrument utilized a five-point Likert scale for all questions except the first two questions for PSVs addressing budget and schedule performance. The five-point scale included “strongly agree,” “agree,” “neither agree nor disagree,” “disagree,” or “strongly disagree.” The three-point scale used for budget and schedule questions included “agree,” “neither agree nor disagree,” and “disagree.”

### 2.3. Using a Pilot to Check Survey Reliability

For this research a test-retest through a pilot survey was conducted after the Delphi group reached consensus. Pearson’s r has been used to conduct a test-retest correlation [35]. The test-retest in this study was two-tailed striving for significance at  $\rho < 0.5$ . A test-retest involves calculation of a correlation coefficients to compare two sets of responses [38]. Test-retest correlations were moderate to highly positive with  $r > .70$ ,  $\rho < 0.5$  [38].

Cronbach’s alpha was used to test for the internal consistency of the results in the pilot and general surveys [10]. The ideal range was between 0.7 and 0.9 [35]. A Cronbach’s alpha above .9 suggests that redundant questions may be in the survey [35].

### 2.4. Population and sample

The population ideally covered all IT projects in the United States. As this population was too large, a working population or a sub-set of the population was used [51]. In this research the sample was drawn from ZoomInfo. [61]. ZoomInfo’s database contained approximately 5,000 names of managers in IT organizations in the United States with 1,000 or more employees. The employee information included had been updated within the last 18 months.

The following formula was used to derive minimum acceptable sample size [51]:

$$n = Z_a^2 s^2 / ME_i^2 + (Z_a^2 s^2 / N - 1) \quad (1)$$

where:

n = sample size

$Z_a^2$  = desired confidence interval squared

$s^2$  = sample standard deviation squared

$ME_i^2$  = Margin of error squared

(confidence interval in terms of scale)

N-1 = Working population less 1

Based upon initial assumptions that the confidence interval = 95%, standard deviation = 2, margin of error = 0.25 and working population = 4,400, equation 1 was used to derive a sample size of 233.

Based on the actual survey results, the minimum acceptable sample size was recalculated. Data from the surveys received indicated that the highest standard deviation for any of the 32 questions related to the OLFs, PLPs, and PSVs was actually 1.199, not the assumed 2.0. When this change from the assumed standard deviation was entered into formula (1), the

results reduced the required minimum sample size to 87 respondents. In the survey, 101 IT managers responded producing 97 completed surveys.

Researchers have used similar sample sizes in research related to KM in project environments. For research on factors affecting knowledge transfer in IT projects a sample of 68 respondents for a survey instrument that included 51 questions was used that included a similar scale to this research (1 to 5) [30]. In a study on the relationship between improving project management and use of KM the sample size was 99 respondents for a survey containing 43 questions [37]. Finally, in research that evaluated knowledge transfer across projects used a sample of 46 respondents (one per project) to answer 48 questions [32]. Thus, it was decided that 97 respondents were adequate to complete this study.

### 2.5. Statistical analysis

Statistical methods were an essential component of correlational studies [10]. The statistical analysis would prove successful if the results enabled an answer to the research question in a manner that could withstand peer review. Data analysis involved two tasks to answer the research question. The first task was to describe the data to gain a broad understanding of the information. The second task was to answer the research question by use of inferential statistics.

Within the first step, the project data was evaluated noting the frequency distribution, central tendency, variability, and ranking [10, 51]. The descriptive data was used to identify any unusual issues and provide a sense of lessons that could be learned from the survey [51].

The second task addressed the second and third research questions. Pearson’s Product Moment Correlation (two-tailed) was used to correlate the variables in his study [29]. ”Experts differ on the interpretation of the strength of the correlation amongst the variables. As a result Table 3 was developed to enable interpretation using a common lexicon in the top row. Very low and very high are not shown.

**Table 3. Expert interpretation of relationships**

Researchers	Low	Medium	High
Creswell (2005)	.20- .35	.35-.65	.66- .85
Jugdev (2007)	.20- .40	.40-.70	.70-.90
Leech, et al. (2011)	.10-.30	.30-.50	.50-.70
Gray & Kinnear (2012)	.10-.30	.30-.50	.50-1.0

Upon completing Pearson’s Product Moment a multiple regression was conducted to determine what portion of project success could be attributed to OLFs

and PLPs. An Anova was used to test the significance of each of the independent variables (OLF and PLP) in the model derived from the multiple regression.

### 3. Results

#### 3.1. Survey instrument

Table 4 provides an abbreviated version of each question of the survey validated by the Delphi team. The survey contained questions for 12 OLFs, 11 PLPs, and nine PSVs. Column A illustrates construct type, column B abbreviated construct description, and column C the number of articles that provided the basis for the construct

**Table 4. Sample survey questions**

A	B	C
PSV	Budget was within a tolerable variance	11
PSV	Schedule was within a tolerable variance	11
PSV	Delivery was within final customer specifications	3
PSV	Quality (bugs, user interface, maintainability, reliable data, and smooth implementation)	9
PSV	Delivered measurable organizational benefits	8
PSV	Customer satisfaction base on objective feedback	8
PSV	Communications between customer and the team	Delphi
PSV	Change control process in place	Delphi
PSV	Mitigated all risks	Delphi
OLF	Trusting and supportive culture enables knowledge sharing	24
OLF	Senior management support	20
OLF	Sufficient resources to support knowledge sharing	11
OLF	Training in knowledge sharing	12
OLF	Access to information systems that facilitate knowledge sharing	31
OLF	Can locate an expert without knowing name or location (expert locator)	9
OLF	Sufficient time in the schedule for knowledge sharing	8
OLF	Requirement exists to do post-project reviews	Delphi
OLF	Process exists to facilitate learning among teams.	23

OLF	Incentives used to encourage knowledge sharing	16
OLF	Organizational structure facilitates knowledge sharing	14
OLF	Staff actively share knowledge through personal communication (informal).	15
PLP	Last team benefitted from post-project reviews completed within the same organization.	12
PLP	Used lesson brought from earlier projects within the same organization	3
PLP	Brought right skills and experience to the team	8
PLP	Team networked inside and outside of organization to gain knowledge	5
PLP	Lessons learned were disseminated during the kick-off meeting	4
PLP	Outside resources enabled knowledge sharing among teams	5
PLP	Information systems facilitated knowledge sharing	11
PLP	Team actually located an expert without knowing name or location using directory or IT system	Delphi
PLP	Team evaluated lessons learned by other teams for appropriate use in current project	9
PLP	Applied lessons learned by other projects	11
PLP	Team captured lessons learned from its experience	Delphi

#### 3.2. Administration: Sample description

The sample for the pilot test came from a convenience sample of 15 IT managers with experience in large corporations. The pilot group was asked to take the survey twice with an interval of two weeks between the surveys [38]. However, three people in Pilot 2 took the survey about four weeks after the initial pilot.

In this research, the general survey introduction was sent to 4,986 people and was posted on a website [5]. A letter was then sent to 3,340 potential respondents. Addresses were not available for all people in the initial working population and the initial population. Following up on the letter campaign, two email reminders were sent. From these efforts 101 people responded, producing 97 usable responses.

### 3.3. Reliability: Pilot and general surveys

The test-retest showed a positive correlation between pilot 1 and pilot 2. The PSVs, OLFs, and PLPs had correlations of 0.919 (.01 sig.), 0.727 (.01 sig.), and 0.57 (.05 sig.) respectively.

Cronbach's Alpha was calculated from the pilot data for the PSVs, OLFs, and PLPs. N is double the number of questions because both Pilot 1 and Pilot 2 were included in the results as shown in Table 5.

**Table 5. Cronbach's Alpha for pilot**

Variable	Cronbach's Alpha	N
PSVs	.860	18
OLFs	.894	24
PLPs	.889	22

Cronbach's Alpha was also calculated for the general survey as shown in Table 6. All Cronbach's alpha studies fell between 0.8 and 0.9; the ideal range.

**Table 6. Cronbach's Alpha for general survey**

Variable	Cronbach's Alpha	N
PSVs	.802	9
OLFs	.887	12
PLPs	.862	11

### 3.4. Relationship among Constructs

Descriptive statistics were captured in Table 7.

**Table 7. Descriptive statistics**

Variable	N	Min.	Max.	Mean	Std. Dev.
PSVs	97	2.44	4.78	3.72	0.56
OLFs	97	1.33	4.50	3.09	0.76
PLPs	97	1.30	4.73	3.25	0.69

Table 8 indicated a positive correlation amongst the three constructs significant at the 0.01 level (\*\*).

**Table 8. Correlations among PSVs, OLFs, and PLPs**

	PSV	OLF	PLP
PSV	1	.537**	.474**
OLF	.537**	1	.705**
PLP	.474**	.705**	1

Using the common interpretation across the top of Table 3, the results maybe interpreted for each expert and combined in Table 9. This permits a judgment to be made about the strength of relationships in qualitative terms which most experts may accept.

**Table 9. Interpretation of correlations**

Researcher	OLFs – PSVs	PLPs – PSVs	OLFs – PLPs
	0.537	.474	0.705
Creswell (2005)	Medium	Medium	High
Jugdev (2007)	Medium	Medium	High
Leech, et al. (2011)	High	Medium	High
Gray & Kinnear (2012)	High	Medium	Very High
Finding	Medium/High	Medium	High

The multiple regression model is illustrated in Table 10. The table shows that 30% of project success was related to OLFs and PLPs.

**Table 9. Multiple regression results**

R	R <sup>2</sup>	Adjusted R <sup>2</sup>	Std. error of the estimate
.553	.306	.291	.47530

Anova results showed that the regression was statistically significant ( $f = 20.727, p = 0.000$ ). OLFs taken separately were also statistically significant ( $\beta = 0.394, t = 3.251, p = 0.002$ ). PLPs were not statistically significant ( $\beta = 0.200, t = 1.654, p = 0.101$ ).

### 4. Conclusion

This research demonstrated a positive and significant correlation among organizational learning, project learning, and project success in IT organizations. The correlations among the variables were significant at the .01 level. The multiple regression indicated that the combination of PLPs and OLFs, accounted for approximately 30% of a project's success. Thus, learning may be an critical success factor to enable project success in IT organizations.

Yet this research has limitations. Originally, a goal of this research was to achieve 233 respondents using a conservative standard deviation of two. This goal was not achieved. Using the sample sizing formula again based on the highest actual standard deviation the acceptable sample was revised to 87 respondents. In this study 101 IT managers responded, producing 97 valid responses. In addition, the test-retest for PLPs at 0.57 was less than 0.70 recommended by experts.

The aforementioned limitation may have led to the finding that PLPs did not contribute significantly to the multiple regression in this study. The methods employed for the content analysis, and the Delphi

teamwork may also be factors. The content analysis was based upon 220 citations in support of OLFs but only 83 citations for PLPs. During the Delphi team process it was somewhat more difficult to reach consensus on the PLPs. This suggests that more research is necessary to define PLPs and understand their use. The research also confirms that OLFs are an important framework for learning. For example, if an organization lacks trust, leadership, and incentives it is less likely that project teams will implement PLPs. Knowledge management to-date has primarily been focused on the organizational level. There appears to be a significant opportunity to improve knowledge of learning at the unit or project layers.

The finding of a positive relationship amongst OLFs, PLPs, and PSVs and the significant contribution of learning to project success is similar to other research findings. A relationship was found between knowledge transfer amongst project teams, their consultants, and users which in turn correlated with user perceptions of system quality ( $r = .45$ ) and user benefits ( $r = .53$ ) [34]. A causal relationship was found between systems integration project success and team member knowledge [27]. Also, a relationship was found between KM practices and project management [37]. In other research it was found that the combination of traditional project management practices and KM enabled schedule and budget predictability [25]. Elsewhere research found a positive relationship between organizational learning and work performance [52]. Also, research concluded that culture and leadership, organization and processes, and information systems correlated with KM effectiveness in project-based organizations [39]. Learning companies in 159 of 264 months out performed the S&P 500 index [19]. Positive relationships between KM and organizational success in the literature validated the results of this research.

Specific cases illustrated a relationship between project success and learning. Duke Engineering and Services reported that applying lessons learned for projects in which generators were replaced at power stations achieved good results [56]. Using lessons learned the company was able to reduce the critical path of the emerging project by 33% while accomplishing 27% more work. In another specific endeavor an IT KM system and a process enabled research and development projects over six years to shorten project lead times [26]. Alcatel-Lucent developed a KM process and reported that 89% of the sales and marketing forces considered the tool an important for their jobs [14]. The company also uncovered 40% of all defects sooner in the process enabling a cost savings of 30%.

Fong theorized that some repetition of processes improved learning prospects among projects [17]. Fully 66% of the respondents worked on projects in which the organization had prior experience. Another 28% worked on projects new to the company suggesting that an emphasis on external networking, benchmarking, and alliances may be helpful to improve project success. Thus, 94% of IT projects may benefit from knowledge flow among projects. .

The demographics, strength of the correlation among OLFs, PLPs, and PSVs, and the relatively high proportion of project success that can be attributed to learning suggest that IT organizations have an opportunity to improve project success using KM. KM related to projects is an emerging field of study that offers exciting opportunities for further research.

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