A Global Study on ICT Project Performance

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There is a perception of low performance in the information communications technology (ICT) industry with various differing opinions as to the source of the low performance. As technology becomes more integrated within all aspects of society the need for high performance is critical. This research focuses on understanding project performance in the ICT industry. Through literature research an analysis and compilation was performed with 56 publications related to project performance factors, reported performance statistics, and solutions to improve ICT project performance. The research findings establish a definition of performance, identify the current level of performance within the ICT industry, identify existing solutions to the ICT industry and a prioritized listing of 25 factors of project performance.

Keywords: ICT Industry, performance, performance factors.

Introduction

The information communications technology (ICT) industry has had perceived performance issues for years. Performance issues have been identified as early as in 1968 when in a software engineering conference, the so called “software crisis” was addressed (NATO Science Committee, 1969). The crisis was due to the number of software projects failing to be finished on time, on budget, and which met the correct specifications. At the time, the proposed causes of failure included:

1. Complexity of systems.
2. Suppliers lacked expertise due to a lack of experience.
3. Rushed projects due to pressure of meeting the owner’s deadlines.

The only consensus to these problems at that time was that the solution was unknown; however, guidance was given to continue to improve on current techniques and not to work outside the present state of technology.

Since 1969 technology has advanced significantly and the methods and theories to deliver ICT projects with it. Methodologies such as rapid application development, the V-model, spiral model, lean software development, and agile methodology have been refined over the years in addition to the supporting tools and software to address the challenges encountered in delivering ICT projects.

Multiple studies and theories of project performance both in the academic and private industry have continuously developed common factors related to project performance. An example of this can be seen as early as 1975, when Frederick Brooks published The Mythical Man-Month. He outlined factors and practices of performance that are still recognized today. One of the most known is linked to the factor of poor project planning and coordination of resources coined by the phrase “adding manpower to a late software project makes it later” commonly referred to as Brook’s law.

Even with all these advancements within the ICT industry throughout the years, the “software crisis” may not appear to have been resolved. A landmark study published by the Standish group (1994) reestablished the issue when it identified that 83.8% of ICT projects failed to be completed on time and on budget, and projects that were completed by the largest American companies had only 42% of their original features and functions.

The ICT industry is deeply integrated into all industries from healthcare to construction due to the growing dependencies for technology in day to day activities. The challenge of performance has been seen in all sectors of the ICT industry. The latest report published by the Standish Group (2016) focused on eight of the major sectors and revealed little differential in project success.

Research Questions and Methodology

The purpose of this paper is to clarify and understand project performance in the ICT industry. The research seeks to answer the following research questions:

1. How can project performance be defined?
2. What is the performance level of the ICT Industry?
3. What factors are related to ICT performance?
4. What documented solutions have shown to improve performance?

To answer these research questions, an exploratory literature review has been performed to identify, understand and analyze the existing studies of performance in the ICT industry.

Keyword & Database Searching

In the literature research ’ICT Project Performance’ and ‘ICT Project Performance Factors’ were used as the core keywords. The main search engines that were used include Engineering Village, Emerald Insight, Pro Quest and Google Scholar. Engineering Village is comprised of 12 engineering literature and patent databases. In total, the database is comprised of more than 16 million records from over 68 countries and 1,000 publishers. Emerald Insight focuses on research in the practice and management of business. Emerald Insight manages a portfolio of nearly 300 journals, more than 2,500 books and over 450 teaching cases. Pro Quest also focuses on research into business management but extends their database to include dissertations, news, and the latest working papers.

Filtering Criteria

Following the search with the identified keywords, 4 steps or filters were used:

1. The publications had to be available in full text English.
2. Each of the keywords was researched in 400 publications in each of the databases.
3. Publication abstracts were reviewed and filtered based on relation to ICT project performance.
4. Publications were fully reviewed and filtered based on the contribution of either (1) performance metrics (2) an identified list of project performance factors and/or (3) a distinguishable method to improve performance with supporting metrics.

After the review of 1,600 publications' abstracts (see Table 1), 222 were identified to have abstracts related to project performance. After the full publications were carefully read and reviewed, 28 publications were identified to contribute with original project performance information (directly related) and from those 28 publications, 28 more were identified through references used in those papers. In total 56 relevant publications were identified that each presented relevant information to project performance.

Through the 56 studies of ICT project performance it can be observed that the challenges with performance in the ICT industry are not specific to one country. The ICT issues are global. Table 2 gives an overview of the locations where these studies have taken place specifically within the countries of United States, United Kingdom, Finland, The Netherlands, Australia, China, New Zealand, Canada, South Africa, Singapore and Belgium. However, there are some studies which do not disclose the specific countries such as Hoffman (1999) but report surveying over 16,000 companies in 28 countries.

Table 1: Literature Search Results.

Key Word Searches	**ICT Project Performance & ICT Project Performance Factors**		
Source	Searched	Related	Directly
Engineering Village	400	60	10
Emerald	400	45	4
ProQuest	400	70	8
Google Scholar	400	47	6
Total	1600	222	28

Table 2: Demographics of Literature Results, 34 Publications.

Publication Year	#
2016 - 2017	3
2011 - 2015	20
2006-2010	13
2001-2005	13
1969-2000	7

Location	#
General	28
Specific Location(s)	28
Asia	3
Europe	15
Americas	16
Australia	2
Africa	2

Analysis & Findings

From the 56 publications related to ICT project performance the following information was collected:

1. 22 publications that outlined a definition of performance summarized in 7 common factors.
2. 25 publications reporting ICT performance metrics to find the practitioners perception of performance in the ICT industry.
3. 19 publications with identified lists of factors of project performance (success/failure) analyzed to create 25 general factors of project performance.
4. 22 publications pertaining to an identified method to improve performance which are supported by performance metrics.

After reviewing the data collected from the 56 publications, an analysis was performed to answer the identified research questions. To answer the first and second research questions (RQ1 and RQ2), an analysis was performed on publications which defined or reported project performance metrics. The third research question (RQ3) was answered by analyzing all publications which identified a list of factors of project success or failure. The fourth research question (RQ4) was answered by analyzing solutions which provided documented performance metrics to support their claims of improved performance.

Defining Project Performance

In the analysis of the 22 publications which defined performance, 7 factors were identified to be used to define performance. The two most common factors include on budget and on time being cited in over 17 out of 22 publications, see Table 3. The lowest cited factors include cancellation, quality, and use, which were all cited in less than 7 of the 22 publications. The factors of client expectations / satisfaction and required features and functions were close with 14 and 11 publications citing respectively.

In setting a definition of performance it is clear that time and cost are crucial factors. However, the remaining factors are less dominantly expressed in the publications. To simplify the definition other groups have proposed the remaining factors be grouped into the factor of client expectations or satisfaction as the factors of required features and functions, cancellation, quality and end use all seem to be relevant to the user's expectation or satisfaction with the end result (Standish Group, 2016).

As there is no consensus as to the perception of what constitutes performance, a workable definition must be identified. For this research, based on the literature project performance is defined to be: a project implementation with the criteria of being on time, on budget, and meeting client satisfaction.

Table 3: Defining Performance

Defined Performance Factor	**Frequency (out of 22)**	**%**
On budget	20	91%
On time	17	77%
Client expectations / Satisfaction	14	64%
Required features and functions	11	50%
Cancelled prior to completion	7	32%
Quality	4	18%
Delivered and never used	3	14%

Project Performance Metrics

Of the 34 publications related to project performance, 25 publications reported statistics within the ICT industry. Major studies on the performance metrics of the industry over the years include (listed chronologically):

1. The Standish group (1994). The study surveyed 365 respondents with multiple personal interviews. The findings identified that 83.8% of ICT projects failed to be completed on time and on budget, and projects that were completed by the largest American companies had only 42% of their original features and functions.
2. IT-Cortex (2014) Reported four different studies done on ICT project performance. (1) In 1995 the Organizational Aspects of Information Technology (OASIG) UK group sampled 45 experts primarily employed by Universities or consultancies. The interviews resulted in the identification that the success rate of IT projects is estimated at 20 – 30%. (3) In 1998 the Bull Survey performed 203 telephone interviews with IT project managers who took the lead in integrating large systems within organizations in the Times Top 100 and reported that with the IT projects 75% missed deadlines, 55% exceeded budget and 37% were unable to meet project requirements. (4) In 2001, the Robbins-Gioia survey of ERP systems reported that 51% of ERP implementations were viewed as unsuccessful, 46% of the participants noted that while their organization had an ERP system in place, or was implementing a system, they did not feel their organization understood how to use the system to improve the way they conduct business.

3. Hoffman (1999) reported the results from Howard Rubin's annual worldwide IT trends and benchmark report which surveyed more than 16,000 IT professionals at 6,000 companies and in 28 countries. The results reported 85% of IT organizations in the US are failing to meet their organizations strategic business needs.
4. Whittaker (1999) reported a study done in 1997 surveying chief executives of 1,450 public and private sector organizations across Canada in the ICT industry, of which 176 were analyzed. The findings included 87% of failed projects exceeded their initial schedule estimates by 30% more. This compare to 56% of failed projects that exceeded their estimated budget by the same amount, and 45% of failed projects which failed to produce the expected benefits
5. Taylor (2000) analyzed 1,027 projects and interviewed 38 practitioners of the association of project managers and institute of management. The findings revealed that out of the 1,027 projects only 130 or 12.7% were successful.
6. Sauer and Cuthbertson (2003) from Oxford surveyed over 1500 practicing IT project managers and found that 16% of projects end up with an average cost overrun of 18%, schedule overrun of 23% and 7% underachievement of scope / functionality.
7. KPMG (2005) conducted a global IT project management survey of more than 600 companies in 22 countries. Some of the dominant results showed that in the past 12 months 49% of participants experienced at least one project failure. In the same period only 2% of organizations achieved benefits all the time, and 86% of organizations lost up to 25% of target benefits across their entire portfolio.
8. The European Services Strategy Unit (2007) reported 105 outsourced public-sector ICT projects with 57% of contracts which experienced cost overruns with an average cost overrun of 30.5%, average schedule overrun of 33% and 30% of contracts which were terminated or never used.
9. The US Accountability office (2008) identified 413 IT projects--totaling at least $25.2 billion in expenditures for the fiscal year of 2008--as being poorly planned, poorly performing, or both. With just under half being re-baselined at least once.
10. The Genenca group's (2011) survey included 600 U.S. businesses IT executives and practitioners and reported that 75% of respondents admit that their projects are either always or usually doomed right from the start, of which 27% always felt this way (2011).
11. Flyvbjerg and Budzier's (2011) entry for the Harvard Business Review did an analysis of 1,471 IT projects and reported an average cost overrun of 27%, of which 17% had a failure high enough to threaten the company's existence, with an average cost overrun of 200% and schedule overrun of 70%.
12. McKinsey & Company (2012) analyzed over 5,400 projects and reported 50% of IT projects on average are 45% over budget, 7% over time, 56% less value than predicted and 17% of projects end so badly they can threaten the life of the company.
13. The Standish Group (2016) analyzed their database of over 25,000 projects to find that 61% of projects failed to complete on time, on budget with a satisfactory result.

Other performance metrics have been reported without details such as the year the study was conducted, or methodology used to explain the metrics. Although these performance metrics are not as dominant they are important to consider when examining the perception of the industry:

1. 15% of all software development never delivers anything, and has overruns of 100-200% (DeMarco, 1982).
2. There is a 50-80% failure rate of large projects (Dorsey, 2000).
3. An estimate of 5-15% of all large-scale software projects are cancelled in the USA and the total yearly cost of cancellations may be as much as US $75 Billion (Savolainen & Ahonena, 2010).
4. Kappelman et al. (2002) cites two studies: (1) reporting 20% of IT projects are cancelled before completion and less than a third are finished on time and within budget and expected functionality. (2) study reports these numbers to more than double when considering large projects with 10,000 function points.
5. Fenech and De Raffaele (2013) report three different studies: (1) an independent study by McCafferty revealed that 25% of the projects will not succeed in meeting the requirements, amounting to around $63 billion annually spent on such failed initiatives, (2) a global study held by Gartner for 845 ICT companies concluded that 44% of the analyzed projects exceeded budget allocations, 42% failed to be delivered within agreed timeframes and over 42.5% lacked in achieving all expected benefits by the end of the project, (3) Young’s study reported that 15-28% of ICT projects in Australia were abandoned prior to implementation, around 30% experienced significant cost overruns sometimes up to 189% and less than 20% had achieved all the established performance objectives.
6. As many as 25% of all software projects are cancelled outright, as many as 80% are over budget, with the average project exceeding its budget by 50%. It is estimated that three-fourths of all large systems are operational failures because they either do not function as specified or are simply not used (Schmidt et al, 2001).
7. Dijk (2009) reports that 34% are successful, 51% does not go according to plan but ultimately does lead to some result and 15% of the projects fail completely.
8. Molokken and Jorgensen (2003) studied 6 different studies to find the performance statistics varying for ICT projects. Cost overrun was reported by four studies with 33%, 33%, 34% and 89%. Projects completed over budget was reported by four studies with 61%, 63%, 70%, and 80%. Projects completed after schedule was reported by three studies with 65%, 80%, 84%.
9. Procaccino et al. (2002) cited two studies: (1) in 1994, 31% of all corporate software development projects resulted in cancellation and (2) a more recent study found that 20% of software projects failed, and that 46% experienced cost and schedule overruns or significantly reduced functionality.

Multiple countries have addressed the issue of ICT project performance on a governmental level including the United Kingdom, the Netherlands, Australia and the United States. The UK government has spent over 16 billion on IT projects in 2009 in a wide range of areas, yet the UK has been described as “a world leader in ineffective IT schemes for government”. In 2011 the House of Commons in England appointed a special committee to investigate the state of their government IT performance (Public Administration Committee, 2011). In addition to lessons learned and the identification of the sources of failure, the investigation revealed various high costing IT initiatives over the last twenty years which ended in failure. (Public Administration Committee, 2011).

In 2012 - 2014 a Netherlands parliamentary inquiry was held to address the poor performance of ICT projects in the Public space (The House of Representatives of the Netherlands, 2014). During the enquiry, it was reported that 1-5 billion Euros are wasted in the Netherlands with ICT projects annually. Recent and notable projects by the media and government inquiry included (The House of Representatives of the Netherlands, 2014):

1. Defense department project (SPEER) cancelled after spending € 418 million.
2. Belastingdienst ETPM project cancelled after spending € 203 million.
3. Police Investigation Suite (PSO) Cancelled in 2005 after spending € 430 million.
4. C2000 emergency police and others implementation costs € 72 million overbudget due to delays.
5. Payroll administration (P-direct) failed tender costs of € 200 million with a potential € 700 million more.
6. EPD Electronic Patient File cancelled after spending € 300 million.

In 2013 – 2014 the Legislative Assembly of the Northern Territory of Australia held a government inquiry that was prompted by ongoing concerns raised by the Auditor-General regarding the management of information and communication technology projects (Legislative Assembly of the Northern Territory, 2014). The chairperson of the committee commented that it was clearly unacceptable to spend over $70 million only to make systems worse. In the inquiry three large government projects were specifically analyzed:

1. The department of infrastructure’s attempt to replace their nine legacy systems used to manage the Government’s asset management information systems and business processes with an integrated commercial off the shelf product (COTS). The project was budgeted at $14 million and to be completed on April 10th. The project was cancelled in March 2014 where it cost around $70 million.
2. The Power and Water Corporation (PWC) project to replace a suite of old systems which were poorly integrated and no longer supported by the suppliers. The project was budgeted at $15 million and to be completed on March 12th. The project was completed in August 2012 where it cost approximately $51.8 million.
3. The Department of Health’s grant management system project was to develop and implement an ICT system to support the management of service agreements with NGOs. The project was budgeted at $684 thousand and to be completed in November 2011. The project was still in progress with an expected budget of $979 thousand and with an expected completion date of June 2014 when the last report was created.

The United States has not held an official government inquiry however from 2011 – 2014 the United States has also experienced similar high failure rate with government IT projects, reportedly spending billions of dollars on projects which are incomplete, cancelled, or nonfunctional. Recent and notable projects include:

1. The USAF's attempt to automate and streamline their logistics operations by consolidating and replacing over 200 separate legacy systems. The project was cancelled after spending $1.1 billion, project incomplete and nonfunctional (Institute for Defense Analysis, 2011; Kanaracus, 2012; United States Senate Permanent Subcommittee on Investigations, 2014).
2. The state of California's attempt to merge 13 separate payroll systems into a single system that served 243,000 employees. The project was cancelled after spending $254 million and had proven to be nonfunctional (Chiang, 2013; Kanaracus, 2013).
3. The Census Bureau's attempt to convert to handheld computers for the 2010 census. The project was cancelled after spending up to $798 million for a nonfunctional product (Nagesh, 2008; US Department of Commerce, 2011).
4. The IRS's continual attempt to update their system from legacy software. Multiple projects have been cancelled with over $4 billion spent (Hershey, 1996; Moseley, 2013; Thompson, 2012).
5. The US Government's online healthcare website, "Obamacare" was originally budgeted for $93 million. Official statements of costs have not been calculated but estimations calculated it to be as high as $634 million (Costello & Mcclaim, 2013; Dinan & Howell, 2014; Vlahos, 2013).
6. The Federal Aviation Association's attempt to consolidate their terminal automation system for an initial $438 million; the cost overrun has been estimated to be $270 million. The project was still ongoing and is nonfunctional according to the last reports of the project (Levin, 2013; Perera, 2013).

The various performance studies and reports performed through surveys, interviews, and case studies use different types of performance statistics, methods to achieve those statistics and values of those performance statistics. It is also unmentioned, in most studies, the ICT sector being measured. Each reported study also defines performance in a different way. Due to these factors, it is unclear and not verifiable to determine a universal performance level of the entire ICT industry. However, from the literature we can conclude that there is a general consensus that, the ICT industry is perceived to have performance issues. The chronology and time period which the performance metrics cover also reveals that the ICT industry has been experiencing these perceived issues with performance for multiple years.

Factors of Project Failure

Of the 56 publications related to ICT project performance, 19 were found to have identified a list of factors of ICT project performance (success/failure). In analyzing these 19 publications, we identified 325 factors that were cited to be linked to ICT project performance (success and failure). We found that although the factors were worded differently, many of the factors were similar. Additionally, for practicality and usability, many factors could be grouped into a larger, broader factor. After fully reviewing all factors there were 25 overall factors that were identified. In Table 4 the factors are prioritized in terms of the number of publications (of the 19) in which it was cited. Publication frequency was determined as a more accurate prioritization tool as some studies identified lists which were exhaustive in both critical factors and minor. By using publication frequency of factors, the risk of minor factors outweighing critical factors would be minimized. (Al-ahmad et al., 2009; Dorsey, 2000; Emam & Koru, 2008; Geneca, 2011; Henderson, 2006; IT Cortex, 2014; Jiang et al., 1999; Kappelman et al., 2002; Keil, Tiwana & Bush, 2002; Mckinsey, 2012; Michael, 2002; Milis, & Mercken, 2002; Nasir & Sahibuddin, 2011; Sauer & Cuthbertson, 2003; Savolainen & Ahonen, 2010; Standish Group, 1994; Standish Group, 2016; Taylor, 2000; Yeo, 2002).

Table 4: Factors of Project Performance.

#	Project Factors	Publication Frequency (out of 19)	%
1	Project planning / estimation / coordination of resources	16	84%
2	Project team's capability (technical knowledge, resources, and skills)	15	79%
3	Undefined, Unclear, and/or misunderstood project scope (requirements, objectives, and purpose)	14	74%
4	Changing project scope (requirements, objectives, and purpose)	13	68%
5	Support of top management and leadership	13	68%
6	Client involvement	12	63%
7	Project managers capability (technical knowledge, resources, and skills)	10	53%
8	Project alignment with the business objectives, goals, and needs of the organization	10	53%
9	Project management methodology	9	47%
10	Communication between stakeholders	8	42%
11	Capability to manage project scope changes	7	37%
12	Creation of an unrealistic requirement	7	37%
13	Project alignment with the organization's conditions	7	37%
14	Capability to track and understand performance throughout project execution	6	32%
15	New technology, tools, and/or methods	6	32%
16	Support and approval of user / client	6	32%
17	Rapid development of deliverables	3	16%
18	Definition of roles and responsibilities	6	32%
19	Undefined project success criteria	5	26%
20	Multiple interacting parts (suppliers, systems, organizations, departments, community, etc.)	4	21%
21	Conflict between client stakeholders (Departments, organizations, etc.)	4	21%
22	Lack of user education and training	4	21%
23	Project team not given enough control over the project	3	16%
24	Risk management	3	16%
25	Large project size (duration and cost)	3	16%

The 325 factors were then grouped by 6 categories, shown in Table 5. Table 5 shows the average publication frequency of the factors by category. Of the factor categories, capability is the most cited by the publications. Scoping, planning and the buyer – supplier relationship ranked relatively similar in importance. However, although the ICT industry is known to be an industry of changing technology and "mega" projects, technology and size were the least mentioned for publication frequency.

Table 5: Factors of Project Failure.

Factor Category	Average % Publication Frequency
Capability	51%
Scoping	45%
Planning	43%
Buyer – supplier Relationship	42%
Technology	24%
Size	18%

With any of these studies of ICT project performance factors it is important to consider that there is no consensus as to the exact factors. Nasir and Sahibuddin (2011), Wateridge (1995) and Fortune and White (2006), conducted similar studies of ICT project performance factors, all of which concluded that there is no broad consensus among researchers and practitioners in determining project performance factors.

Literature (Nasir and Sahibuddin, 2011; Sauer and Cuthbertson, 2003; Dorsey, 2000) reveal that the project manager (PM) has been a primary focus of the identified factors. This may be due to the perceived role of the PM, defined by the Project Management Institute PMBOK Guide (2017). For example, the PMBOK describes the role of a project manager to be summarized in 10 areas of knowledge include: 1) Integration, 2) Scope, 3) Schedule, 4) Cost, 5) Quality, 6) Resource, 7) Communications, 8) Risk, 9) Procurement, 10) Stakeholder.

Using the definition of the PMBOK (2017), the PMs role can be observed to interact with most of performance factors as summarized in Table 6. Of the 25 factors listed in Table 4, 16 are not specifically cited within these 10 areas. The reason they are not mentioned could be attributed to the factor specifically mentioning the level of capability the project implementer:

1. Factor #2: Project team's capability (technical knowledge, resources and skills).
2. Factor #7: Project manager's capability (technical knowledge, resources and skills).

Or because the factor is dependent on the buyer or predetermined conditions that are not clearly seen as the responsibility of the project manager. These factors are interestingly amongst the lowest cited, 3 of 4 being amongst the least cited.

1. Factor #15: New technology, tools, and/or methods.
2. Factor #22: Lack of user education and training.
3. Factor #23: Project Implementer not given enough control over the project.
4. Factor #25: Large project size (duration and cost).

Table 6: Project Manager Responsibilities and Performance Factors.

#	Project Management Process Group and Knowledge Areas	Performance Factor(s)
1	Project Integration	5, 8, 9, 13, 18
2	Project Scope	3, 4, 12, 19
3	Project Schedule	1, 11, 14, 17, 20
4	Project Cost	1, 3, 4, 11
5	Project Quality	14
6	Project Resource	1, 18
7	Project Communications	10
8	Project Risk	24
9	Project Procurement	-
10	Project Stakeholder	5, 6, 10, 16, 20, 21

#	Other Areas	Factor
1	Specific to project implementer's capability	2, 7
2	Determined by buyer or project conditions	15, 22, 23, 25

Nasir and Sahibuddin's study (2011) found that the project manager could control the top 5 critical risks or a project (clear requirements and specifications, clear objectives and goals, realistic schedule, effective project management skills and methodologies, and support from top management). Sauer and Cuthbertson (2003) indicated similar findings with their study's recommendations being to improve on the capability of project managers. Dorsey's (2000) research listed the top three reasons for failure to include: top management support, a sound methodology and a solid technical leadership. Taylor's (2000) results also describe the project manager's role related to these factors including gaining the support and commitment of top management and ensuring clear communication between stakeholders.

The analysis of the overall 25 performance factors listed from the 19 studies (Table 4) in combination with previous research, gives greater insight into the importance of the capability of the project implementer to performance.

ICT Proven Solutions

Of the 56 publications related to project performance, 3 methods were distinguishable with supporting research to show improved performance in the ICT industry. There are many broad approaches that have been suggested to improve performance, such as improving governance of projects or greater goal alignment (The House of Representatives, 2014; Milis and Mercken, 2002), however when in the search for approaches, only approaches which were distinguishable as a standardized method and which had supporting research reflecting improved performance were considered.

The first approach is the Agile project management methodology used by the project implementer (Beedle, et al., 2001). Its success has been attributed to its ability to handle complexity by utilizing the capability of the project implementer in short timeframes called sprints. Cutter Consortium (2008) identify the methodology as a method to deal with the increasingly complex software and system. The Scrum Alliance (2013) promotes that Agile practices are a key adaptation that organizations are making in the face of heightened business complexity. QSM Associates (2009) identifies that the disruptive factors of complex sourcing have already driven most of organizations towards iterative processes and Agile approaches. VersionOne (2007) survey reported that 67% of respondents agreed that agile improved the reduction of process complexity.

Agile has become mainstream in the ICT sector with as high as 84% of ICT companies practicing agile methodologies and over 5,000 Project Management Institute (PMI) certified practitioners, making it the fastest growing PMI certification (Project Management Institute, 2014; Scrum Alliance, 2013; Serena, 2012; VersionOne, 2013). In comparing this new development methodology to traditional approaches, the Standish group concluded Agile had a success rate (delivered on time, on budget, with required feature and functions) 28% higher compared to the traditional waterfall approach (Standish Group, 2011). Various other industry reports and surveys support the Standish group with claims of improvement in cost, time to market, risk, defects and productivity when switching from traditional methodologies to agile (Cutter Consortium, 2008; QSM Associates, 2013; Scrum Alliance, 2013; Shine Technologies, 2002; VersionOne, 2007).

The second and arguable simplest approach proposed is to make projects smaller. This is a deductive manner that would minimize the project scope in terms of project conditions such as the number of stakeholders, integration between conditions, duration, etc. The assumption is that smaller projects would be, by definition, less complex and would result in better results (Sauer & Cuthbertson, 2003). The Dutch Parliamentary noted during their inquiry that projects are “too large and too complex” (The House of Representatives, 2014), identifying the fact that large projects are significantly more likely to fail than smaller. The Standish group (2013) reports a high level of success with smaller projects compared to large projects with a 66% difference in success rate (Table 7). Success in this situation being determined by delivery on time, on budget, with required features and functions.

Table 7: Large vs. Small Projects.

	Small Projects	**Large Projects**
Success	76%	10%
Fail	4%	38%

***** Small projects are considered <$1 million in labor cost, Large project >$10 million.
Source: Adapted from the CHAOS Report 1995. Boston, MA: The Standish Group International, Inc.

The Standish Group (2011) initially reported the benefits of using the agile project management method over the traditional waterfall approach by comparing the success rate (in terms of on time, on budget, with required features and functions) of 14% to 42% based on their database of performance metrics. However, in a more recent report (Standish Group, 2013) measuring only small projects under one million dollars, the benefit of the project management approach was minimized with a difference of success of 3% (see Table 8). These findings suggest a decrease in project size results in a decrease in the importance of the project management approach or project implementer's capability. Therefore, with smaller projects, the need for project management capability may be reduced.

Table 8: Large vs. Small Projects Methodology.

	All Projects (2011)		**Small Projects (2013)**	
	Waterfall	**Agile**	**Waterfall**	**Agile**
Success	14%	42%	49%	46%
Fail	29%	9%	8%	6%

Source: Adapted from the CHAOS Report 2011 and 2013. Boston, MA: The Standish Group International, Inc.

Results of the Giarte Study (2014), that is conducted annually to ICT clients/buyers in the Netherlands, analyzed ICT project size as well. This third-party performance measurement firm conducted an analysis with the ICT performance rating information they had collected for their 2012, 2013 and 2014 annual reports. Giarte compared the client's satisfaction on large and small projects in the ICT infrastructure management domain from both midsize and large providers. From the results the following can be observed (Table 9):

1. Midsize providers in all three years received higher customer satisfaction in their small projects than the large providers for both small and large projects.
2. Large providers for 2012 and 2013 received higher customer satisfaction on their large projects than their smaller projects.
3. In 2014 large providers received higher customer satisfaction on their smaller projects.

The results differ from the Standish Group and Dutch Inquiry's conclusions of ICT project size and ICT performance as it would suggest that project size may have less of an impact than the project implementer. Sauer & Cuthbertson (2003) in analyzing the UK projects noted similar results showing the results of projects regardless of size are similar, differing however, only with projects as they become extremely small or extremely large.

Table 9: Percentage Satisfied Respondents, Infrastructure Management.

	Midsize Providers	**Large Providers**	
	****Small Deals**	****Small Deals**	***Large Deals**
2012	88%	59%	70%
2013	89%	76%	85%
2014	90%	85%	79%

** Deals considered large are >5 million EUR / year*
***Deals considered midsize are < million EUR / year*
Source: Adapted from the Outsourcing Performance 2014 Report by Giarte.

The third approach is the Best Value Approach (BVA) which was was first conceived through research at Arizona State University (ASU). The BVA is a philosophy and methodology which focuses on utilizing the capability of the project implementer (supplier in most cases) to improve performance and minimize complexity (Kashiwagi, 2017). A study conducted in 2013 comparing BVA to other traditional processes found a key differentiator to be that the BVA used an expert supplier model (Kashiwagi, 2013). The BVA has been heavily documented to be successful in improving performance including (PBSRG, 2014):

1. Most licensed university developed technology at Arizona State University with 38 licenses issued by the innovation group AZTech at Arizona State University. BVA tests have been conducted in 31 states in the U.S. and five different countries besides the U.S. (Finland, Botswana, Netherlands, Canada, and Malaysia).
2. Documented performance of over 1,700 projects delivering $6 billion (1629 projects, $4B in construction and 89 projects, $2B in non-construction), customer satisfaction of 9.8 (out of 10), 93.5% of projects on time and 96.7% on budget.
3. Research tests show that in procuring of services outside of construction, the observed value is 33% or an increase of revenue or decrease in cost of 33% (Kashiwagi, J., 2013).
4. The results of BVA testing has won the 2012 Dutch Sourcing Award, the Construction Owners of America Association (COAA) Gold Award, the 2005 CoreNet H. Bruce Russell Global Innovators of the Year Award, the 2001 Tech Pono Award for Innovation in the State of Hawaii, along with numerous other awards.

The BVA has been analyzed by outside groups multiple times. However, there were two investigations that performed a thorough study on the impact and effectiveness of the system. These studies all confirmed that the performance claims of the BVA system were accurate:

1. The State of Hawaii Audit (Kashiwagi et al. 2002; State of Hawaii Report 2002 (DIS)).
2. Two Dutch Studies on the Impact of PIPS (Duren & Doree, 2008; Rijt & Santema, 2012).

Specifically in the ICT industry case studies have been documented to show improved performance:

1 The State of Oklahoma COTS-ICT Tax software (Kashiwagi, 2014).
2 ICT Networking for one of the largest Universities in the United States (Rivera, 2014).
3 Port of Rotterdom and a large ICT vendor to (Kashiwagi et al. 2015).
4 Large ICT vendor's sales and marketing group (Kashiwagi et al. 2015).
5 The municipality of Eesmond telephone facilities (Logemann & Kashiwagi, 2017).

All three approaches differ in how to improve performance but all three approaches similarly identified an importance of the project implementor's capability when improving performance.

Conclusion

The focus of this paper was to further investigate the level of performance in the ICT industry by answering the research questions of R1, how can project performance be defined; R2, what is the performance level of the ICT Industry; and R3, what factors are related to ICT performance? In response to R1, project performance was found to be most commonly defined by time, cost and customer satisfaction. Customer satisfaction is a compilation of various related factors such as cancellation, end use, quality and features and functions. This definition is relevant as it was taken from 22 publications which presented performance metrics or factors in which the definition was applied.

In response to R2, it was found that there have been multiple studies and reported statistics of the ICT industry. The difficulty is that the type, method of collection and value of statistics being reported are varied. With the existing reported statistics, it would not be possible to set a standard level of performance for the ICT industry. However, there is a common consensus of all the metrics and context given that millions of dollars are being lost each year due to performance issues and that the ICT industry is perceived as having performance issues with the need to improve.

In response to R3, 25 general factors of performance were identified that effect project performance, with planning, project team's capability, and an undefined scope as the top three reasons respectively. The factors were further analyzed by 7 categories which revealed capability of the project implementer as one of the most crucial and new technology and project size as the least critical. This was confirmed by previous literature, emphasizing the importance of the project implementer.

In response to R4, 3 solutions were identified with documented performance metrics to support their ability to improve ICT project performance. Among the three included are the agile methodology, making projects smaller, and the Best Value Approach. All three were determined to be different but similar in their focus in improving performance through their focus on the capability of the project implementer.

Reflections

The study attempts to be complete in understanding project performance within the ICT industry, however, there are potential limitations due to the small sample size of publications and key words that were reviewed (1,600 publications and 2 key words). A more exhaustive literature search could have been performed, however as all reported statistics have followed the same trend in terms of performance statistics and factors, this study can be considered a sort of microcosm of the existing performance statistics in the entire ICT industry. The study captures all current well-known performance statistics and can be added as new statistics are discovered.

The ICT industry covers a wide range of services, these services or sectors vary in performance conditions depending on the service. In the studies examined, specific services of the ICT industries were not identified. The author recognizes that all sectors in the ICT industry may not follow the general trend in the ICT industry in terms of the level of performance and performance factors. However, to understand the level of performance without expending resources ourselves to perform all the studies, a literature search was deemed the most effective tool. An acceptable factor with the literature search is to be limited by the content of the studies performed by other researchers.

The method of compiling and comparing performance factors was limited in terms of the consistency and quantity of characteristics. Each list that was used had a different number of characteristics listed. The author found it more beneficial to minimize the risk of incorrect interpretation and decision making by including all characteristics and using frequency cited in a publication instead of the quantity of characteristics to prioritize the factors.

With the findings of this research the author has identified that the poor performance and causes of failure have been relatively unchanging for many years, even with the constant improvement in existing solutions. The author feels it is necessary to conduct further research in order to reexamine the approach and root causes of the ICT project failure and further the development of research into solutions with regards to the supplier's expertise.

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