

# A Critical Analysis of Software Product Failure: An Indian & Global Perspective



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**Abstract:** *The software industry is acting as an engine for economic growth and development of a Nation. Over the past two decades, software became a key factor for the smooth operation of almost every type of industry and among all sectors of organization. The software industry has great positive and disproportionate impact on world's financial growth, export, jobs and economy. The success and growth of the software industry is directly dependent on the successful completion of the final delivered software products and successful completion of final software deliverables are highly depended on quality of requirements. In current scenario requirements are uncertain and not fixed. As per human tendency not to constant with their necessities therefore clients/ professionals behaviors are also in changing nature hence requirements keep on changing thus highly influences the successful completion of software projects hence performance of the software industry. That is why requirement management plays very critical and crucial role in the successful development of software projects. The main motive of this research study is analyzing various important facts and figures about software industry and their influences in various sectors of a country. Findings from the various survey and reports shows that how requirements are influencing and impacting in the success of software projects. It is being analyzed that requirement uncertainty plays very crucial role in the successful development of a software projects. The major reasons behind such a high rate of failure, factors and causes of software projects being analyzed and discussed with rigorous literature review.*

**Index Terms:** Requirement Management, Software Projects, Software Failure, Software Industry.

## I. INTRODUCTION

The software industry gets its highest level of success from its zero level inceptions within a century and became the breathing component for its user and produces. Today, software forms the basis of many modern devices, such as PCs, smart phones, tablets and navigation systems that we have come to rely on so heavily in our everyday lives. In the forthcoming years more numbers of gadgets and apparatuses, such as home appliances, watches, cars and even glasses, are produced into "intelligent" devices, the software product market will just proceed to extend and advance. The rapid pace of development has been observed over the last few decades [1]. This analysis is capable to predict the future of software companies in the year to come.

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BSA appointed EUI (The Economist Intelligence Unit) to lead an investigation, on the financial commitments of software products [2], [6]. The research study found that at present in US only, software product division is producing more than trillion dollars per year in financial effect [2]. And IT sectors are also creating lucrative employments, software designers are earning more than double to the normal yearly earnings of all other US business. At the same time software development keeps on flourishing, and making a swell or massive impact that fortifies different IT segment and the economy.

In the current era of globalization and day to day changing technological aspects, the IT industry is keener to evolve user-friendly and reliable software as deriving force to give new hike in automation as the horizon of computing society which will certainly give economical and financial footmarks for the others involved in the same field. The research shows that with extra expenditure in R&D, the IT businesses are placing more assets to the inventive future of US [2]. This analysis can be helpful for the policymakers and initiators to enhance and quantify the impact of flourishing IT sectors on the other fields. IT industries act like an economic booster for producing new business, employments and enterprises.

This paper discusses the software industries share in the economic growth and development of a country and tries to explore and examine several reasons and factors for the failure of software projects. Furthermore the impacts of software failure are analyzed. The paper addresses the following research questions.

RQ1: The ratio and growth rate of software industry: An Indian & global perspective.

RQ2: Impact of software industry on economic growth, development and employment of a country.

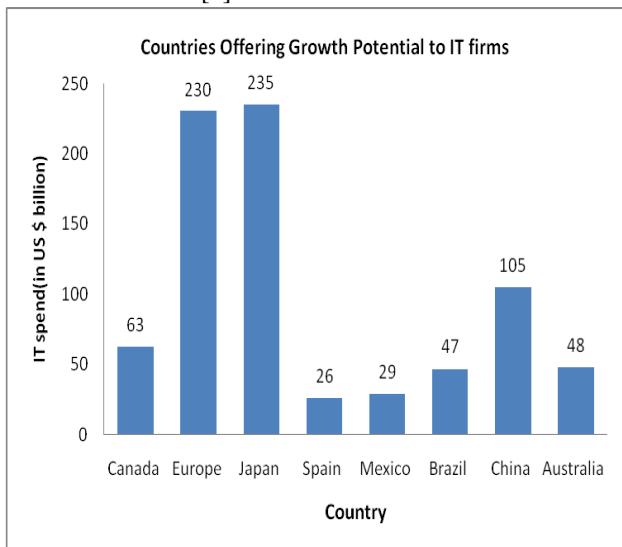
RQ3: Software project failure, failure rates and its impact.

RQ4: Common factors and causes for software project failure.

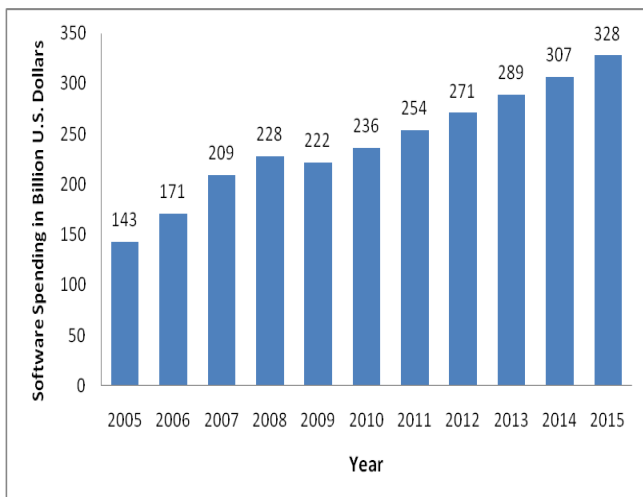
## II. SOFTWARE INDUSTRY TRENDS

Every year, software industries growth in various fields such as application based software, business intelligence software, network access software, software for managing organization system, security improvement software and other hardware interacted software are unlocking new opportunities to improve our life standards. Significant investments in software advancement, exceptional technological innovations are changing each phase of our life, by raising our wealth. But software's significant economic impact has gone unseen or under measured.

The figure1 shows that how different countries spending more and more in IT firms [1]. The global software spending reached 328 billion U.S. dollars from 143 billion U.S. dollars since 2005 to 2015 [2].

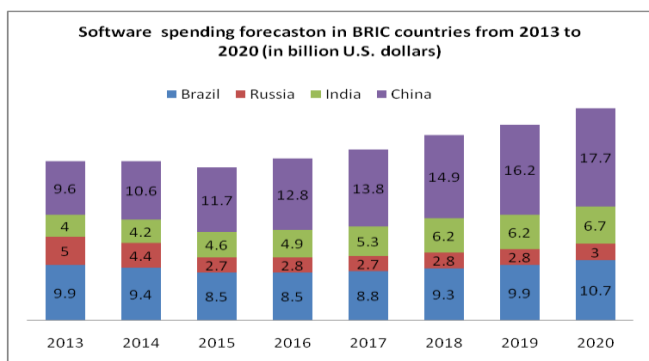


**Fig: 1 Countries offering growth potential to IT firms [2]**



**Fig: 2 Global software spending from 2005 to 2015[2]**

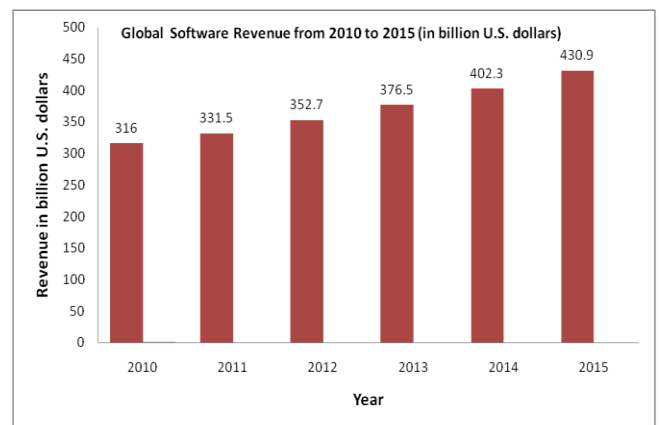
According to IBEF statistic shows the forecast expenses on packaged software in Brazil, Russia, India and China (BRIC). In 2019, software spending in china and Brazil are expected to reach to reach 16.2 and 9.9 billion U.S. dollars. IT market of BRIC countries are expected to achieve US\$ 380–420 billion in 2020. BRIC countries would be able to provide nearly US\$ 380–420 billion likelihood by 2020 [4].



**Fig: 3 Forecast spending on software in BRIC countries [1]**

### III. IMPACT OF SOFTWARE INDUSTRY ON ECONOMIC GROWTH AND DEVELOPMENT

The rapid growth of innovation in software industry reflects its usability and adapted by nearly every other industry and sectors. Positive economic impact of software advancement can be seen over national and international economic contribution to GDP, creating opportunities, lifting earnings, and securing our future. Research shows that from last twenty years, software industry investments are increasing with double than other business investment. Economists since 1990s are trying to investigate and evaluate the impact of software industry investments. The global packaged software revenue increased 316 billion U.S. dollars to 430.9 billion U.S. dollars from 2010 to 2015 [1].



**Fig: 4 Global software revenue [1]**

The amount of revenue generated by the IT industry worldwide in 2016 was more than 1,357 billion euro made through software, hardware and IT services [1]. According to Software & Information Industry Association (SIIA) report published in 2014, impacts of software industries are analyzed on different sectors of U.S. The aggregate estimation of the IT industry's expanded to 2.6% of GDP in 2012 from 1.7% in 1997 in which IT sector's contribution was about \$425 billion to U.S GDP. For the same time period, software industry employments have increased from 1.4 to 2.3 millions. The software industries produced 3.42 million jobs in 2012 and 3.65 million jobs in 2014, and average wages were three times more than the average wage of other private U.S employees. The software organization has kept on making new employments at solid rates. From 2007 to 2014, on an average employment grow by 3.1 percent in private-sector software industry per-year. The Economist Intelligence Unit (EIU) of BSA tried to determine the impact of software's on U.S economy. The major key finding of the study reports are:

- In 2014, software industries contributed \$475.3 billion to the US economy.
- The software products were in charge of an absolute \$1.07 trillion of all US esteem included GDP in 2014 [5].

- Research depicts that the software business helps an aggregate of 9.8 million jobs position by direct and indirect software supports [5].
- Software industries have increased earnings more than twice the national average through jobs. For instance, programmers earned \$108,760 approximately in 2014, greater than twice of the normal employee earns \$48,320 for all US profession [5].

Fig.5 shows, in 2016, U.S. software distributors produced approximately revenue of \$204.7 billion [1].

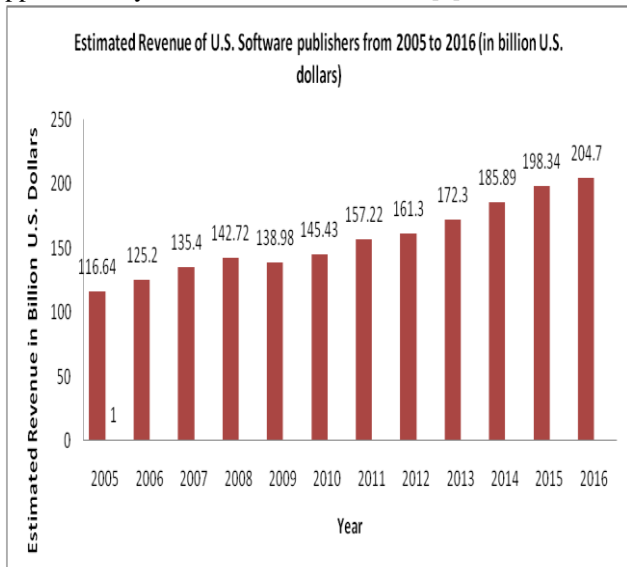


Fig: 5 Estimated revenue of U.S. software publishers [1]

BSA report published in 2016 shows the economic contributions of software industry in European Union. The analysis gives critical bits of information on how European Union (EU) can utilize software’s prospective. Software products contributed a total of €910 billion to the GDP i.e. 7 percent of the European Union’s total GDP [6]. Software’s provided 3.1 million direct jobs that is 1.4% of the total jobs of EU, and 11.6 million total jobs i.e. 5.3% of total EU jobs. Average annual wage for software industry was €45,333 that was 34% greater than the average wage of EU and 80% greater than the average wage earned by EU services sector. Total of €139.2 billion yearly wages was paid by the software companies. In EU almost €12.7 billion invested in software R&D by the software industries in 2013 i.e. 7.3% of the total R&D investment by the business venture [6].

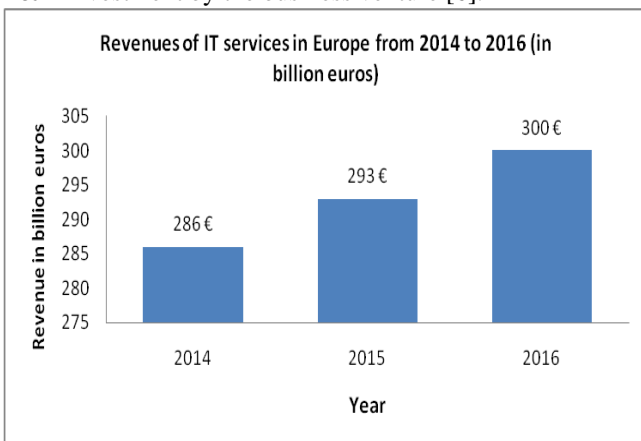


Fig: 6 Revenues of IT services in Europe [6]

#### IV. IMPACT OF SOFTWARE INDUSTRIES IN INDIA

Software and IT industry are one of the largest industries among 10 large scale industries in India [7]. The IT companies in India are playing a key role in country’s economy. The journey of software industry started in 1970. Software industries in India have provided a great achievement for the emerging economy. Indian software industry is having a compound growth of about 60% per year [8]. The software industry in India has grown more than 30 percent over past two decades. Software industries in India accounts for 12.3% to the global market, mainly caused by exports [8]. India exports software services to almost 100 countries. Software industries in India have increased its contribution to the nation’s GDP from 1.2 % to 9.5% during the period from 1998 to 2015 [8]. According to NASSCOM aggregate revenue of software industries reached to US \$ 157 billion in the year 2017 [8].

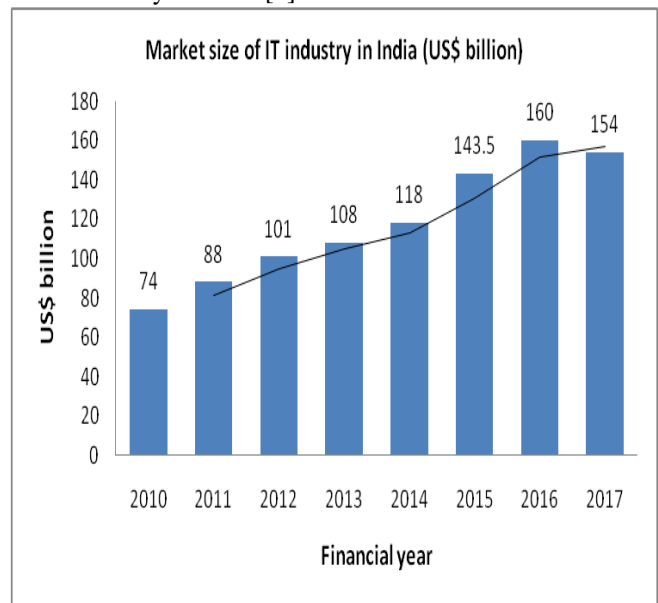


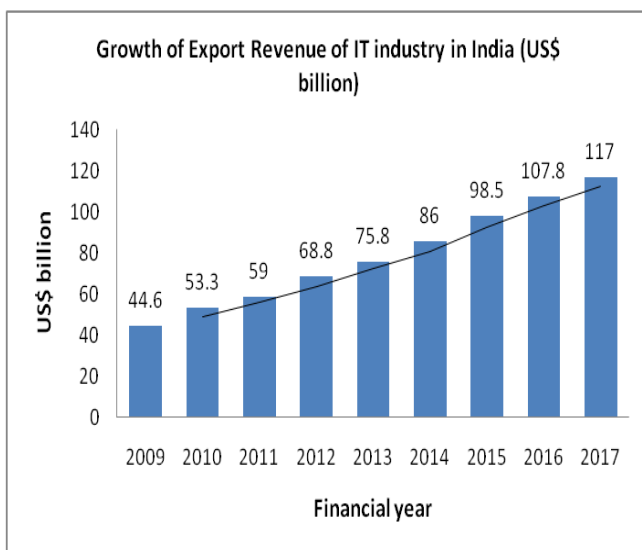
Fig: 7 Market size of IT industries in India [9]

Key findings of various reports like press Information Bureau, Department of Industrial Policy and Promotion statistics, and Union Budget 2017-18, are [9]:

- As per report mentioned by IT-BPM, the CAGR is 13.7% for the year 2010 to 2016 which shows higher ratio in comparison to the global value which will grow by 350 billion USD by 2025.
- In the administration sourcing business, India capture almost 56% share in the market which makes it one of the top sourcing destination worldwide.
- In the Business Process Management, India captures almost 38% of the whole sourcing market.
- India is one of the largest extremely skilled and talented pools of technical graduates in the world, encouraging its development as a favored goal for outsourcing. Software engineering/data innovation represents the greatest lump of India’ crisp building ability hub, with greater than 98 % of the schools are providing this course.

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- The IT industries in India capture approximately 37% of the total Private Equity and business enterprise in the nation's interest.
- In the fiscal year 2016, Indian IT-BPM income from promotions is estimated to touch 160 billion USD.
- In the past five years, IT sectors of India have made customers to save 200 billion USD.
- 670 offsite development hubs have been established by the Indian IT-BPM industry across 78 nations.
- The five best IT organizations of India added over 25% to the whole business returns signifying that the market is absolutely progressive.
- India continued to world's top leading sourcing target with 55% offer during the year 2016-2017.
- More than 1,000 global communication centers have been established in almost 200 metropolitan communities worldwide.
- It is estimated that growth rate of Indian E-commerce market are expected to rise by 30% per year to touch almost 200 billion USD by 2026.
- IT industries in India are estimated that digital wealth of the country may touch 4 trillion USD by 2022, compared to 1 trillion USD predicted by the government of India.
- It is estimated that the overall investment on software by the banks and defense organization in India is estimated to increase by 8.6% annually and predicted to reach 7.8 billion USD through 2017.



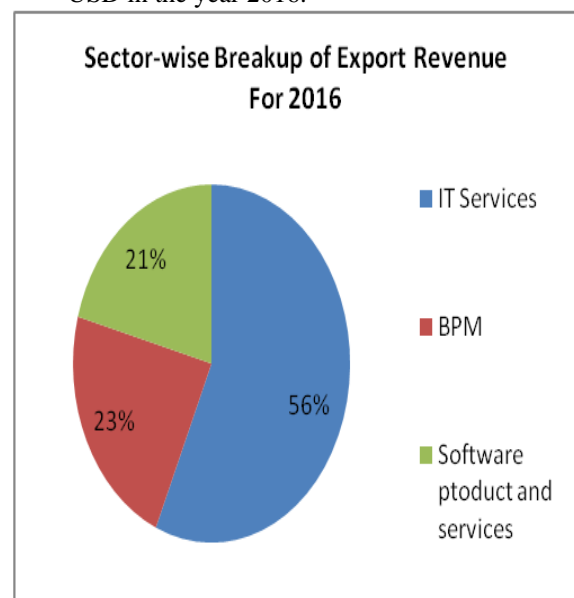
**Fig: 8 Growth export revenues of IT industry in India [10]**

Following are the significant improvement in the IT sectors of India [10]:

- According to Korn Ferry Digital Sustainability Index report, India is at 9<sup>th</sup> position among 14 countries.
- In the fiscal year 2016-17, India remained at 3.04 billion USD in the flexi staffing market of IT sector and is expected to increase approximately 16% to touch 5.3 billion USD by the year 2021.
- Investment in private equity by the IT sector of India has increased with rate of 93% in the year 2017 and

expected touch 2.7 billion USD.

- In the fiscal year 2016-17, Indian IT services exports rise with 10.3% per year and expected to touch 97.1 billion USD as per the Reserve Bank of India reports.
- Investment by the Indian firm on artificial intelligence is expected to increase by 8% to 11% approximately in the forthcoming years.
- By the year 2020, India are planning build 5G wireless technology 5G which will be helpful for the country to think about the objective to increase GDP rates, digitization of the economy and job creation.
- Indian mobile industry is projected to continue its existing rate of development and the worth of its business is estimated to achieve 480 billion USD by 2022, increasing by a rate of 126%.
- Indian export revenue from IT industries is estimated to grow at 7 to 8% and domestic business returns is estimated to rise with 10 to 11% in 2017-18.
- Indian export revenue from IT industries has rise at a CAGR of 12.91% and reached to 117 billion USD in the fiscal year 2017 from 50 billion USD in the year 2010.
- Software industries in India account for 7% of the worldwide market, mainly because of exports. India included 15,000 plus organization in which more than 1000 are huge organization.
- Rising economy are possibly main factor for the contribution to IT expend development.
- IT service exports of India reached 10.3% in the fiscal year 2017 to 97.1 billion USD from 88 billion USD in the year 2016.



**Fig: 9 Sector-wise export revenue for 2016 [10]**

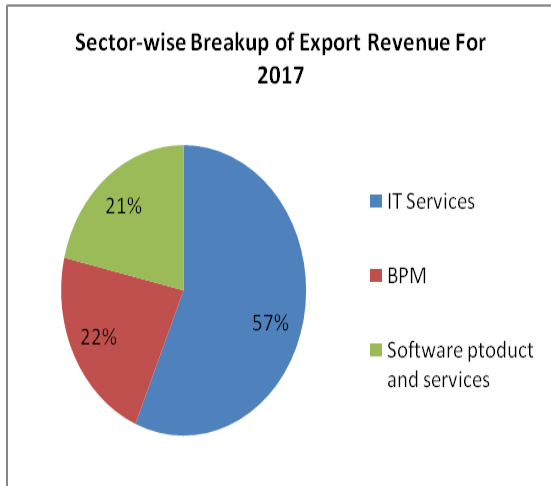


Fig: 10 Sector-wise export revenue for 2016 [10]

**V. PROSPECT AND CONTRIBUTION OF IT INDUSTRY TO INDIA’S GDP AND EMPLOYMENT**

Statistic explain the dimension of the information technology and business process management (ITBPM) industry in India as an offer of India’s total national output (GDP) between the monetary years 2008/09 and 2016/17 [11]. Prospects of employment in Indian IT industry are likely to be encouraging and hopeful for the future.

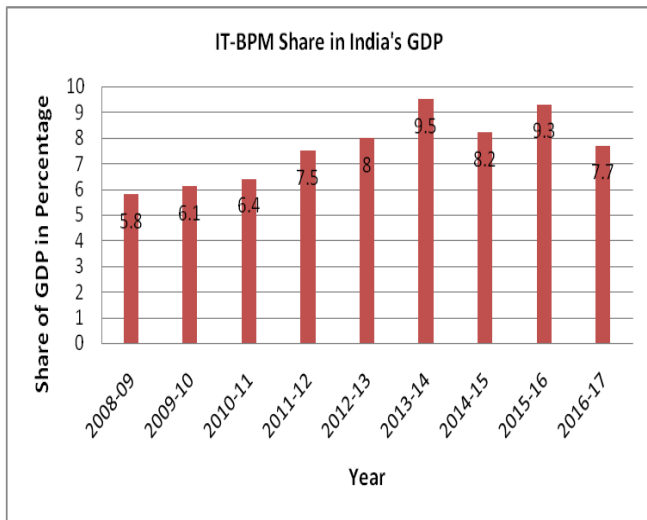


Fig: 11 IT-BPM shares in India’s GDP [11]

It is being analyzed that the employment prospective of Indian software organization is strong and encouraging. The software industries in India presently providing 66% of the capital to nearly 500 industries and generating approximately 4 million direct opportunity in the country[11],[12]. According to NASSCOM report [12], the major business organization, and other reputed autonomous industries implying that domestic software market provides better chance for business growth and development hence producing employment, even if universal business market faced problems. The report also proved that the software industries keep on increasing and better recruiter. Some of the key findings of the reports are [12]:

- Approximately 2.5 to 3 million fresh employments will be provided by the year 2025.
- Indian software companies in the year 2017

introduced 1, 70,000 fresh employments.

- Around 600,000 fresh employments were added in past 3 years by the Indian software industries. And at present provided foundation for the employment of 3.9 million employees.
- Approximately 95,000 to 100,000 IT experts were hired by more than 4,750 newly created Indian IT industries in the year 2016.

Total 4 million direct and nearly 10 million indirect jobs are provided by Indian software industries.

**VI. SOFTWARE PROJECT FAILURE AND ITS IMPACT**

Software project failure is common in software industry. Failure rates of software projects are still alarming [3]. Failures rates of IT projects are still ongoing with the same rate as earlier. It is being analyzed that about 50% of the software projects fail because of several causes. The CHAOS report published by Standish Group in 2015, studied approximately 50,000 software projects around the world. According to the report only 29% projects are successful [13].

From the report it is found that software failure rate are higher for large size project as compared to medium and small size project. Success rate for grand size projects are only 2% where as for small size projects are 62% [13]. A yearly analysis conducted by Innotas in 2016, emphasis that above 50% of software projects fails. 55% project fails which was more than 32% reported in 2014 [14].

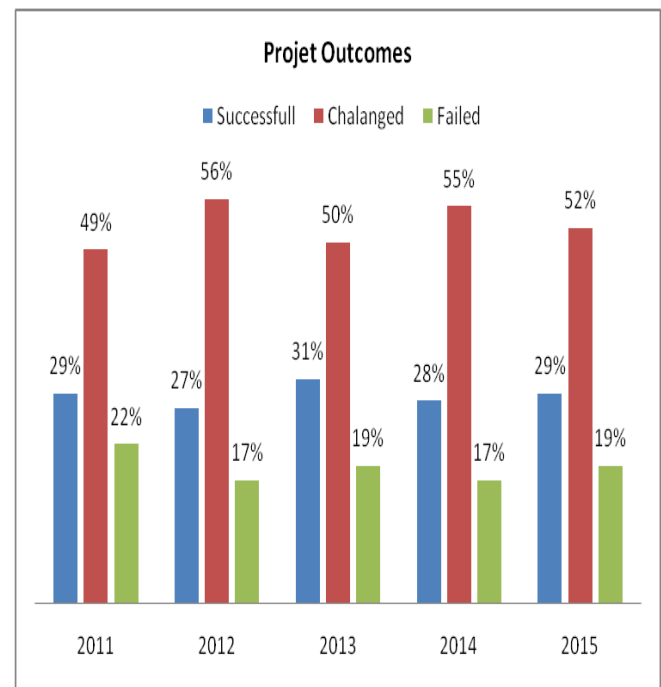
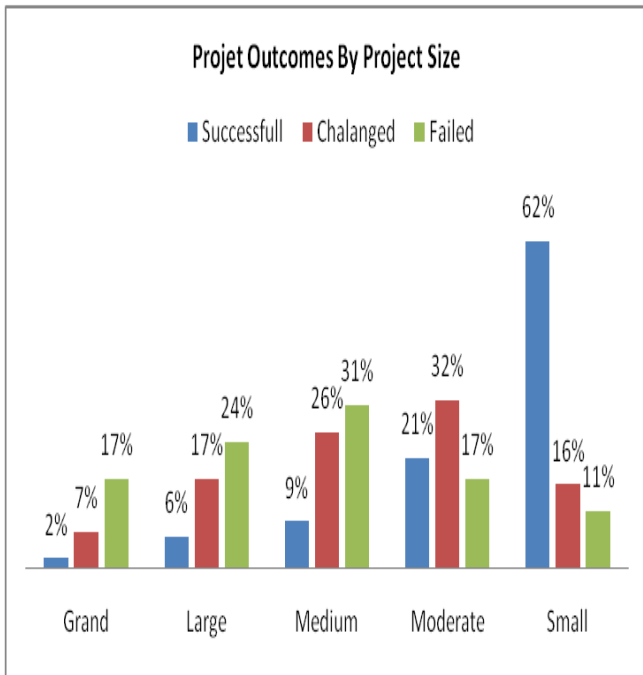


Fig: 12 Project outcomes [13]



**Fig: 12 Project outcomes by project size [13]**

Some of the key findings from recent analysis show [14]:

- For every 1 billion USD investment in software projects, there is a loss of 109 million USD for IT industries.
- It is being analyzed that average cost overrun is 200% and schedule overrun is 70% for one among six software projects.
- Out of every 100 software projects only 39 are considered to be successfully completed within scheduled time and budget.
- The number of challenged project is close to 43 out of every 100 software projects.
- Almost 18% of the projects are considered to be failed as they terminated before the completion or were never deployed.

The results indicates that average project success rates are very low and there is still work to be done in order to achieve better rate of successful outcomes from software development projects.

**VII. SOFTWARE PROJECT FAILURE AND ITS IMPACT**

Failure rates of IT projects are quite high. Uncertain requirement, unclear requirement and requirement change management are some of the root causes for such high failure rate of software project around the globe. Here some facts are listed from various study reports:

Reports/ Survey	Findings
Standish CHAOS Report [15]	<ul style="list-style-type: none"> <li>• Almost 31.1% of the IT projects are cancelled before completion.</li> <li>• Cost overrun for 52.7% of the software projects are estimated to 189% than their original cost.</li> <li>• There are only 16.2% of the</li> </ul>

	<p>projects are completed within scheduled time and budget. The result is poorer in larger scale companies, i.e. approximately 9% of software projects are finished within scheduled time and budget.</p>
IBM Survey Report [16]	<ul style="list-style-type: none"> <li>• Merely 40% of software are successful in order to meet their schedule, budget and objective</li> <li>• Approx 60% software projects are either failed or challenged.</li> </ul>
Portland Business Journal[41]	<ul style="list-style-type: none"> <li>• Approx 65 to 80% of the projects are failing to fulfill their objectives, moreover schedule and budget over run than actual estimation.</li> </ul>
KMPGN New Zealand [17]	<ul style="list-style-type: none"> <li>• Almost 70% of IT industries undergo a minimum one software project failure in the previous one year.</li> <li>• Approx 50% of the projects are unable to reliably meet out the projects goal.</li> </ul>
Harvard Business Review [18]	<ul style="list-style-type: none"> <li>• Just 26% of all projects are successful.</li> <li>• Average cost overrun for the projects was approx 27%, however one among six projects have almost 200% cost overrun and average schedule overrun is almost 70%.</li> <li>• Currently software industries are wasting approximately 97 million in USD for each 1billion investment.</li> <li>• The IT project failure costs about 50 to 150 billion USD annually to the U.S economy.</li> </ul>
Gallup Business Journal [19]	<ul style="list-style-type: none"> <li>• Only 2.5% of the industries are able to complete 100% of their projects successfully. Rest of the projects are either cancelled or challenged.</li> <li>• It is estimated that failure rates of IT projects are almost 5 to 15% which causes aggregate loss of 50 to 150 billion USD annually.</li> </ul>



Gartner survey [20]	<ul style="list-style-type: none"> <li>Failure rates of software projects having budget more than 1 million USD is 50% compared to the failure rates of the projects having budget less than 350,000 USD.</li> </ul>
Calleam Consulting [21]	<ul style="list-style-type: none"> <li>Growth rate of 17 % large scale software is very poor and could be threat for the existence of the organization.</li> </ul>

1. Table: I Software Project Failure And Its Impact

### VIII. COMMON FACTORS FOR SOFTWARE PROJECT FAILURE

There are various reasons of software project failure and all futile projects will have its individual set of problems. Generally these issues fall into two categories. Things the group did do (but did badly) or things the group neglected to do. The key factors for software project failure are the incapability to approximate the cost, resources, and schedule necessary for a software project [39] - [40]. According to many studies, failure rate of software projects is between 50% - 80%. Highly influential reasons that add to the failure of the software projects are recognized through the many researchers as 57% of software projects fail due to communication failure [22], lack of projects management largely affects the result that approximately 50% of all planned projects (about 44%) are noted as futile [23], Uncertain requirements[24], lack of client or customer participation[3], uncertain goals and objectives[25], Poor Requirement Set[26], Lack of Resources[27], Poor requirement management and lack of communication between clients, designers and developers[28], inadequate basis for the project, lack of technical project management, lack of commitment to the project [29], time, cost and customer satisfaction [30] and also project management model [31]. According to software management models of Ropponen & Lytinen (2000) and Ewusi-Mensah (2003), requirements management and changing requirement are one of the most important factors for software failure [32].

According to CAI India Current State (2017) report, lack of change management, change in strategy, and change in environment are some contributing factors to IT project failures. [33]. According to UK Essays (2017) study, unclear requirement is one of the major drivers for software project failure [34]. The consequences of uncertain requirements are very serious. It will lead to cost overrun, faulty product and a lot of modification. The programmers will have to put in extra time and effort for a lot of rework to produce requires modifications [34]. 80% new products and 70% of IT projects fail as a result of incorrect requirements. The estimated costs of these failures are more than 45 billion USD per year [35]. The statistic depicts that one of the main cause behind the failure of software projects is uncertain requirements. According to a worldwide survey made by the developers in 2015, 48% of developers pointed at changing or poorly recognized requirements as one of the major cause for IT project breakdown [36].

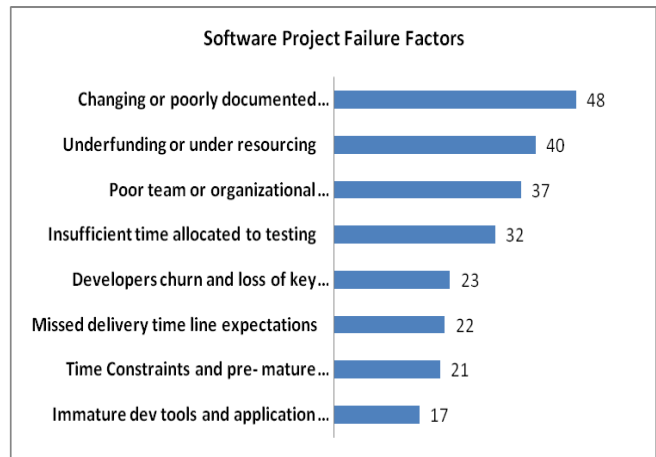


Fig: 13 Reasons for software project failures worldwide, as of 2015 [36].

In the year 2017 PMI (The Project Management Institute) survey report found that on an average there is a loss of U.S. \$97 million for every U.S. \$1 billion invested due to poor project performance. The primary cause of failure is shown in figure 14 [37]. According to Michael Krigsman (2009) [38] findings, which notes that success in 68% IT projects fails due to poor requirements definition. Companies which are using poor requirements practice on their projects have to pay extra cost as much as 60% of the total cost if the projects are on time and budget. Almost 41% budget of software development, staff and external professional services will be consumed by poor requirements.

### IX. CONCLUSION

In the current scenario of day to day changing and emerging models and methodologies for developing software created a great competency of reliable and error free software products. But most of the produced software facing a problem of operational halt and degraded performance in its execution and causes a volumous unexpected faulty action.

In this research article it is being tried to analyze different types of software developed through adopting various methodology with respect to its different characteristics and features. Some of major thematic and empirical analyses are mention below:

- Software is becoming more unreliable due to its time-boxed regular need in the organization.

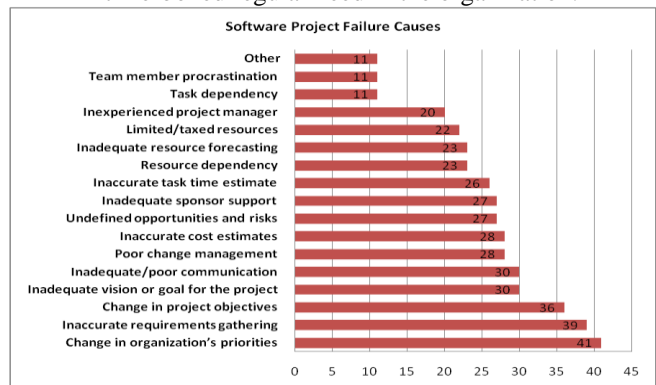


Fig: 14 Software project failure causes [37]

- Fast moving software development methodologies are limiting to only smaller projects and unaligned with the bigger one.
- Failure trends are analyzed at its higher level of usage.
- The occurrence of bug, fault and error becoming higher in rate due to its poor and uncertain requirement statements.
- Software failure giving a higher impact on employment and so forth economical growth of a country.
- It is being analyzed that error prone software increases exponentially in the market and so forth the level of dissatisfaction of the user increases.
- Many features and operability in any software are fully or partially cross dependent therefore if one operability is decreasing or halting or creating errors then dependent may also be lead to erroneous.

Therefore it may be concluded through this research article that software failure leads to unemployment at both end client and developer level henceforth the national growth. Since software industry are becoming backbone of any country's employment, economical growth therefore researcher must consider this issue at its priority for introducing newer and fast moving software development methodologies for its betterment.

## X. ACKNOWLEDGEMENT

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