A Reflection on Why Large Public Projects Fail

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"New research shows surprisingly high numbers of out-of-control tech projects – ones that can sink entire companies and careers"
Flyvbjerg and Budzier (2011).

1 ABSTRACT

There is overwhelming evidence that large IT projects indeed tend to fail, however the extent of failure is debated among academics and practitioners. IT projects seem to fail in both private and public sectors, however failure in public IT projects appear to be more spectacular due to size, visibility in media and political consequences.

We highlight the importance of several contextual issues such as how to handle a diverse set of vendors, how to avoid vendor lock-in, strategizing towards a piecemeal approach to modernization, strategies to counter lack of skilled IT professionals in public service, the importance of organization behavior perspectives such as group dynamics and group formation and finally the importance of proper change management.

By studying contextual issues related to project failure we reveal two core contextual dimensions; size and volatility, from which a new framework – The Contextual IT Project Framework – emerged. The framework is leaning towards conceptions of causal agency theory and is intended to help strategize towards successful projects, paying particular attention to projects possessing what we call "hyper emergent" characteristics. We emphasise the importance of strategizing wisely by splitting large efforts into manageable pieces according to risk profile, yet putting proper measures in place to maintain a clear view of the bigger picture.

Keywords: Public Project Failure, Project Success, Emergent, Causal Agency, Emergent Perspective

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2 INTRODUCTION

The UK government spent some £16 billion on IT in 2009, and the public sector seems to make less effective use of IT compared to the private sector, according to PASC (2011). PASC points out that continuing IT mismanagement in public sector is leading to severe project failures and waste of taxpayers' money. Examples of large scale public projects are listed in Whitfield (2007).

The motivation for this paper is a desire to contribute in reducing the considerable waste of time and money within the public sector on spectacular IT failures. There is a tendency for public service IT projects to become gigantic, and consequently hard to manage.

Dunleavy et al. (2006) introduce what they call an emergent paradigm in public administration, and name it the Digital Era Government (DEG). Citizens as well as businesses expect new, transparent, public services aggregated across agencies and departments. This increased demand from society at large in combination with the pressing need to implement policy reform to reach fiscal sustainability are driving the urgent need for governments to increase efficiency in IT service delivery.

There is a pressing need for governments to avoid gigantic IT failures and rather ensure realization of public service value. Consequently, there is a need for research to better understand why some public projects fail and other succeed. We will explore to what degree projects fail, seek to understand why they fail and suggest what we can do to improve.

In spite of the various reasons cited for project failure, there appears little consensus as to any emerging pattern in the existing literature. The literature points in several directions and all claim a slice of the truth. This paper will look at some of the explanations of project failure and seek to reveal the core underlying causes. Accordingly, we attempt to pull together some of the key themes emerging from existing work on project failure. In sum, this paper will clarify underlying patterns contributing to project failure and stimulate even more debate in this important field among academics and practitioners.

Our key research questions are simple:

1. To what extent do large IT projects fail?
2. Why do IT projects fail?
3. What can be done about it?

In our quest for answers we will draw on the existing, broad literature on project failure, selecting in particular from the literature that has something relevant to say about large public service projects.

3 MAIN FINDINGS

When searching the literature we came across several definitions of "success" and "failure" of IT projects, for example:

- PASC (2011) defines a failure: "[..] late, over budget IT systems that are not fit for purpose".
- The Project Management Body of Knowledge PMBOK (r) Guide (PMI (2008)) does not define failure or success at all, but advice the definition of success to be stated in the project charter.

The Standish Group defines success as follows and differentiates "failure" in two categories as presented in CHAOS (1994):

- Successful project: "The project is completed on-time and on-budget, with all features and functions as initially specified"
- Challenged project: "The project is completed and operational but over-budget, over the time estimate, and offers fewer features and functions than originally specified"
- Impaired project: "The project is cancelled at some point during the development cycle"

The Standish Group definition of success and failure has been challenged by Jørgensen and Moløkken (2006). They ask how to categorize a project that is on-time, and on-budget, but not with all specified functionality. The definition has also been challenged by pro-agile[1] professionals who stress the importance of delivery of value rather than delivery according to pre-determined specifications.

For the purpose of this paper we adapt a pragmatic definition to success and failure inspired by the CHAOS report, but adjusted slightly to accommodate the important issues mentioned:

[1] http://www.agilemanifesto.org/

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Project Success: "The project is completed on-time and on-budget, delivering the expected value"
Project Failure: "The project is either terminated or not completed on-time, or not on budget, or not providing the value aimed for"

By value we mean the sustainable added benefit, i.e. if you need to redo major pieces of the project earlier than anticipated, it should be considered as a failure.

Before we present our literature review, it is worth mentioning that there is a very large body of literature on project failure. The aim of this paper is not to summarize all of this. Rather, we will highlight a selection that will serve as the basis for a new understanding of common denominators as these pertain to the characteristics of public service projects, such as gigantic size, massive complexity and high visibility.

The literature appears littered with 'critical success factors' to guide project success. Fortune and White (2006) highlights that the use of 'critical success factors' have many champions, but also critics. Some of the critics argue that merely listing critical success factors does not reveal important relationships across these factors. Fortune and White suggest a systems model, the Formal Systems Model, as a framing device to deliver the benefits of taking account of success factors while accommodating the criticism. For further study we recommend using this framework, however for the aim of this literature review we structure the review according to the main findings, followed by a literature review analysis.

The selected literature can be characterized along several dimensions. The matrix below illustrates how the literature reviewed can be plotted along two axes: (1) *applicability*, which means to what extent the literature is addressing a narrow segment such as one particular type of projects, a few projects, or a certain geography, and (2) *transparency/reliability*, which indicate to what degree the literature is based on a transparent/reliable research methodology and backed by data.

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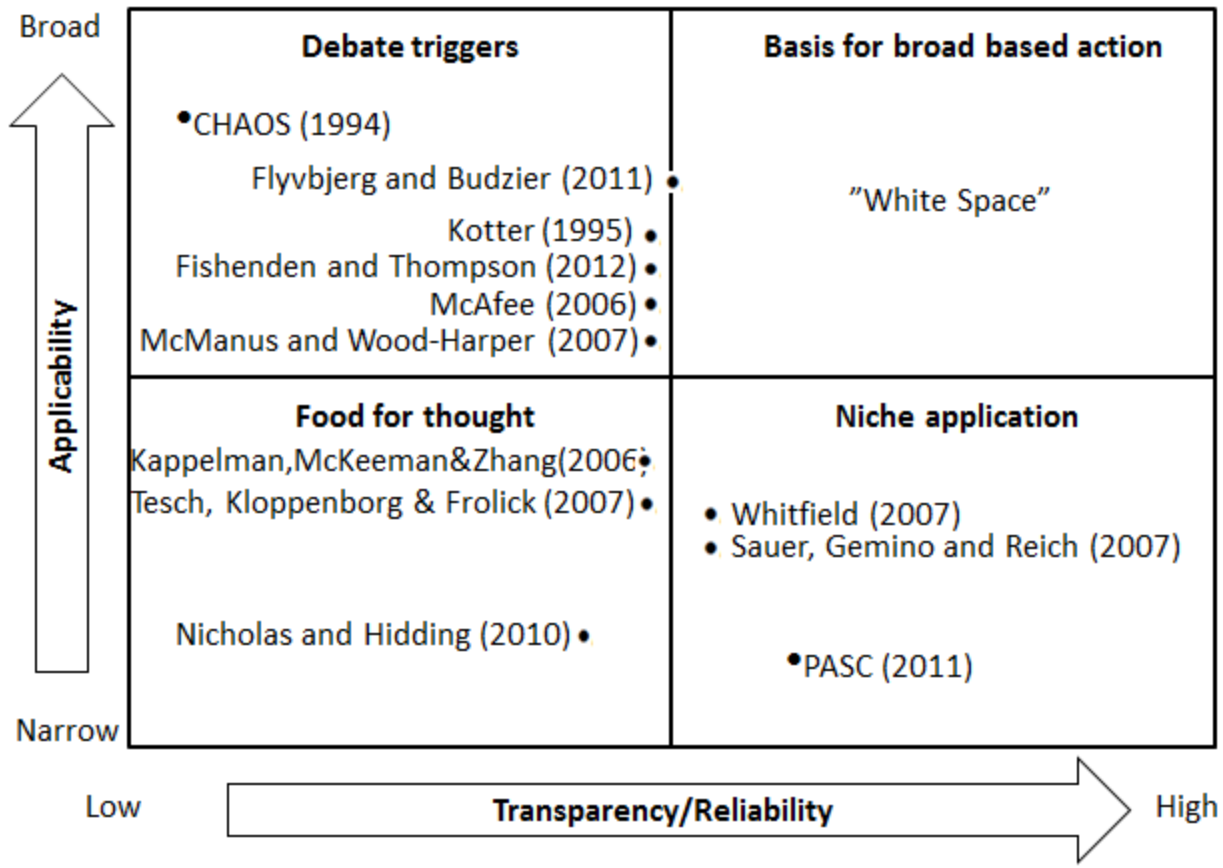

Figure 1 : Literature review : Applicatbility vs Transparency/Reliability (illustrative).

The axes of the matrix is inspired by Flyvbjerg and Budzier (2012).

The "Food for thought" quadrant represents pieces of literature which are suggesting interesting ideas that might deserve further study. The "Niche application" quadrant represents pieces of literature which are backed by select datasets from a particular sector or geography (for example "public service in UK"). The quadrant "Debate triggers" contains broadly applicable pieces of literature which might benefit from further proof and/or transparency. Finally, the quadrant "Basis for broad-based action" proposes 'universal truths' to avoid public project failure, typically backed by solid empirical evidence.

The matrix above is an illustration, and should not be viewed as a precise positioning of each piece of literature. Rather, it represents our subjective observations and illustrates why research in project success and failure indeed is interesting as there is a large "white space" for research that is both highly applicable and transparent/reliable, and upon which one can call for broad based action.

Below we will briefly present each piece of the selected literature according to main findings, and will make cross-references and analysis as we go along. This is followed by a literature review analysis where we suggest a new contextual framework to help strategize towards successful projects. In sum, the following analysis is intended as a contribution to the body of knowledge regarding project failure, as well as to stimulate discussions among academics and practitioners.

We will briefly present the selected literature, clustered around (1) contextual factors, (2) diagnosing failure, (3) understanding failure, (4) preventing failure. This is followed by a consolidated literature review analysis where we suggest a new contextual framework to help

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strategize towards successful projects.

3.1 Contextual factors influencing public IT project failure

The UK Public Accounts Spending Committee (PASC) review of central government ICT, PASC (2011), examined how government uses IT and what the barriers are to further improvement. PASC reports evidence of "IT mismanagement" and points out an array of high cost IT initiatives that have failed over the last 20 years.

The PASC report found that the failure of IT projects was rarely due to the technology itself (like several other reports, for example Hodgson (2002)), rather it was due to mismanagement, flaws in the underlying policy or its implementation. PASC concluded with six underlying causes of failure in government IT:

- Inadequate information, resulting in the Government being unable to manage its IT needs successfully
- An over-reliance on a small number of large suppliers and the virtual exclusion of small and medium sized (SME) IT contractors, which tend to be less risk adverse and more innovative
- A failure to integrate IT into the wider policy and business change programmes
- A tendency to commission large, complex projects which struggle to adapt to changing circumstances
- Over-specifying security requirements
- The lack of sufficient leadership and skills to manage IT within the Civil Service, and in particular the absence of an "intelligent customer" function in Departments

Source: PASC (2011, page 9)

The lack of ICT skills in government and over-reliance on contracting out were reported as fundamental problems which have resulted in poor achievement and constitute even a "recipe for rip-offs". The PASC report stresses the pressing need for government to address the lack of skills and leadership from senior management necessary for the effective procurement and use of IT. The report states "The Government's inability to act as an intelligent customer seems to be a consequence of its decision to outsource a large amount of its IT contracts." PASC (2011, page 32). Further, the PASC report quotes Dr. Mark Thompson of Judge Business School, University of Cambridge, who argues that "there is usually really lousy management of the contract once it is in place" PASC (2011, page 32).

Fishenden and Thompson (2012) take the argument further, and rather than just pointing towards lousy management they call for a new approach to public service IT altogether. Fishenden and Thompson suggest use of open standards and architectures that allow government to become technology agnostic which over time will drive both innovation and reduce cost due to competition. This will, according to Fishenden and Thompson (2011, page 1), "create a powerful dynamic, driving dis-integration of traditional 'black boxed' technologies and services, traditionally organized around 'system integrators' and Departmental structures, and their re-aggregation around the citizen in the form of services."

Fishenden and Thompson highlight the failure of the traditional approach to modernisation of the public sector which has been characterized as the era of New Public Management (NPM). The underlying hypothesis of NPM of private sector style, market-oriented approaches to public services often led to government disaggregating many of its functions. Further, NPM is encouraging competition between different parts of the public sector and between public and private sectors. Dunleavy et al. (2005) highlights that many of the promised benefits of disaggregation had failed to materialise, rather they provide examples of increased administrative complexity, vertical siloing of agencies, and difficulties in co-ordinating joint service delivery.

As a response, Fishenden and Thompson suggest a move towards "open architecture" if government is actually to achieve Digital Era Governance (DEG, Dunleavy et al (2006)). The core of DEG is re-aggregating of public services leveraging under direct government control around the citizen, as well leveraging new technology such as cloud computing, apps development and other recent innovations moving towards an "online civilization" (Dunleavy and Margetts, 2010).

Fishenden and Thompson suggest that Government's intention of minimizing risk in IT delivery remains unchanged within open architecture. However, the role of government will be more to create platform-based incentives for others to take risks while accepting the degree of failure that is an important part of the innovation process.

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The majority of the issues discussed in both PASC (2011) and Fishenden and Thompson (2012) link back - in one way or another - to project size. Some of the reasons why public projects tend to be huge and risky seem to be:

Government typically contracts for large, undifferentiated systems that have not been separated out into high- and low-risk components
Instead of bundling up standardised, low-risk components (which might be more successful), government has outsourced/developed an undifferentiated mix of high and low-risk together, resulting in a inability to identify and control key risks
Proprietary technologies are also typically deeply integrated with supporting business logic, meaning that entire departments/functions/processes need to be tackled in one go, rather than in bits.

We will link back to this discussion of contextual issues when we present a consolidated literature analysis later in the paper. Meanwhile, we suggest that these contextual issues form a useful background to our discussion of the other main findings below.

3.2 Diagnosing failure

In this chapter we will start building our knowledge of the extent to which IT projects fail, according to our research question #1. We will keep returning to the extent of failure in the following chapters, gradually building our understanding.

The Standish Group CHAOS reports on IT failure have been widely referenced and as mentioned earlier in this report, their definitions of success and failure have been debated. However, the CHAOS reports seem to be widely recognized in the industry. The Standish Group publishes a report on IT failures approximately every second year and claims to have been collecting case information on real-life IT environments and software development projects since 1985. Their cumulative research includes 17 years of data on why projects succeed or fail, representing more than 80,000 completed IT projects.

Examples of Standish research findings by year:

	1994	2009
Projects Succeeded:	16%	32%
Projects Failed:	31%	24%
Projects Challenged:	53%	44%

Source: CHAOS (1994), Standish (2009)

The Standish Reports are available, but not freely in the public domain. We have therefore been careful not to reference results from CHAOS years that are not publicly available.

The Standish Group reported in 1994 that the average cost overrun of software projects was as high as 189%, while more recent cost overrun results reported by the Standish Group and others show lower results (Jørgensen and Moløkken, 2006, Table 1). This could be seen as a tribute to advancement in the discipline of IT project management. However, critics such as Jørgensen and Moløkken question the validity of the 1994 CHAOS report and claims most other studies reveal cost overruns in the range of about 30%. As a general note, it is hard to compare such studies due to variations in definitions, for example in the CHAOS report successful projects are excluded from the cost overrun % calculation.

Even though the Standish CHAOS reports are being debated, academics and practitioners seem to agree that the failure rate of IT projects is significant, as presented throughout this literature review.

3.3 Understanding failure

In this chapter we will look at several pieces of literature in order to better understand why projects fail, according to our research question #2. We cross-reference the literature and provide analysis as we go along, gradually building up to chapter **Error! Reference source not found.** which is dedicated to a consolidated analysis.

The impact of size and volatility

In line with Jørgensen and Moløkken, Sauer, Gemino and Reich (2007) also challenge the Standish Group CHAOS reports. In a large-scale study of projects led by 412 experienced project managers in UK, Sauer, Gemino and Reich found that 67% of projects were delivered close to budget, schedule and scope expectations, contrary to the CHAOS findings. However, even though Sauer, Gemino and Reich found the "software crisis" not to be as bad as the Standish Group, it is still alarming. The study's statistical analysis indicates that the IT projects included

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could be categorized into five types of performance:

- Abandoned (9%)
- Budget Challenged (5%)
- Schedule Challenged (18%)
- Good Performers (60%)
- Star Performers (7%)

Further, Sauer, Gemino and Reich reveal some very interesting connections between factors that influence project risk of failure, especially related to project size and volatility.

Size

Sauer, Gemino and Reich reveal that risk of project failure increases with project size, both in terms of effort (man-months), duration, team size and budget. This ties nicely back to our discussion above regarding PASC (2011) and Fishenden and Thompson (2012), which both raise issues linking back to project size.

While projects less than 24 man-months have 25% probability of underperforming, projects with 500-1.000 man-months have doubled the probability to 50%. Projects with 1.000-2.400 man-months have tripled the risk to 75%. No success was found above 2.400 man-months.

Volatility

Sauer, Gemino and Reich define two types of volatility which both influence project risk of failure:

- Changes in project manager or sponsor, and
- Changes in schedule, budget and scope

As the number of changes increases, the risk of project failure appears to follow. The average number of governance changes in better performing projects was 0.4, whereas the average number of governance changes in underperforming projects was 1.5. Also, regarding volatility in schedule, budget and scope, the risk of underperforming increased with the number of these changes per project.

The link between volatility and risk of underperformance is unsurprising given that we measure success based on pre-determined scope. However, pro-agile professionals (referenced earlier) would likely argue that volatility can assist in delivery of what the organization really needs, rather than what the organization thought it needed when the project was initiated.

Sauer, Gemino and Reich conclude that experienced project managers should be able to deliver close (plus or minus 7%) to original target on two out of three projects. The authors also stress that the top management and steering committees have a significant role to play in managing project risk. Ambitious-sized projects, moving targets, and managerial turnover present challenges affecting project risk of failure.

The impact of over-ambitious, complex projects and lack of skills

A report from European Services Strategy Unit (Whitfield 2007) presents an analysis of 105 projects outsourced by central government, NHS, local authorities, public bodies and agencies with significant cost overruns, delays and terminations. Whitfield claims cost increases are often underestimated as the numbers reported usually only include payments to contractors, and not costs borne by the client such as additional client staff engaged. Still, he finds average percent cost overrun at 30.5%.

- 105 outsourced public sector ICT projects with significant cost overruns, delays and terminations
- Total value of contracts is £29.5 billion
- Cost overruns totalled £9.0 billion
- 57% of contracts experienced cost overruns
- The average percentage cost overrun is 30.5%
- 33% of contracts suffered major delays
- 30% of contracts were terminated
- 12.5% of Strategic Service Delivery Partnership contracts terminated or were substantially reduced

Source: Whitfield (2007, page 4, tables 1 and 2)

The report cites the National Audit Office's (NAO) 2003 list[2] of common causes of failure, but Whitfield states that even though these are valid, they rarely get to the root of the problems as they focus primarily on the procurement process. Whitfield's findings are very much in line with both PASC (2011) and Fishenden and Thompson (2012) in that he highlights the following additional causes:

- Some projects are over-ambitious and complex, and the long-term projects face the risk of being over-taken by new legislation, public policy and technology

[2] Whitfield (2007, page 5)

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- Contractors overstate their ability to deliver
- Conclusions by analysts are seldom critically assessed before accepted
- Public clients lack competence in managing large scale projects

The lack of skills in managing large scale projects have been addressed by a number of studies, including Kappelman, McKeeman and Zhang (2006)'s underscoring of the importance of communication skills, and McManus and Wood-Harper (2007)'s highlighting of (among other factors) poor stakeholder communications and poor leadership in project delivery. PASC (2011) addresses this head on by talking about "mismanagement" in public IT. The bottom line is that several studies highlight a lack of skills in managing large IT efforts as a core reason for project failure.

The impact of "black swan"-effects

Based on research of 1.471 large IT-projects, Flyvbjerg and Budzier (2011) found that the average cost overrun was 27%. This finding is in line with the figures reported by several of the papers referenced above, for example Jørgensen and Moløkken (2006) and Whitfield (2007).

However, Flyvbjerg and Budzier (2011) were more alarmed by the fact that one in six projects, or 17%, had cost overruns of 200% on average, and almost 70% experienced schedule overrun. These classic "black swan" projects, they report, can sink companies and cost the jobs of top managers. Levi Strauss, EADS, Kmart, Auto Windscreens (UK), and Toll Collect (Germany) are mentioned as examples.

Flyvbjerg and Budzier suggest taking a "black swan" stress test before engaging in a large technology project. In doing so, they advocate asking two key quesitions:

- Is the company strong enough to absorb the hit if its biggest technology project overruns budget by 400% or more, and if only 25-50% of projected benefits are realized?
- Can the company handle a situation where 15% of its medium-sized projects overruns by 200%?

Source: Flyvbjerg and Budzier (2011)

Flyvbjerg and Budzier also advise managers to decompose large projects into smaller ones of limited size, complexity and duration. This is very much in line with several of the above referenced papers which stress the importance of the size factor, for example Sauer, Gemino and Reich (2007).

Flyvbjerg and Budzier recommend that organizations establish contingency plans to handle risks; and use the best possible forecasting techniques, e.g. Reference Class Forecasting – a method for predicting the future by looking at similar past situations and their outcomes (Flyvbjerg, 2006).

The impact of management & leadership factors versus technical factors

McManus and Wood-Harper (2007) suggest that project management is often undisciplined and chaotic. McManus and Wood-Harper reference their earlier research which found that only one in eight technology projects met the original time, cost and quality requirements criteria, and thereby could be characterized as successful.

McManus and Wood-Harper differentiate between management and technical causal factors , reporting that management causal factors account for 65% of project failures, while technical causal factors account for 35%. This resonates well with several of the above mentioned studies.

Management causal factors include:

- Poor leadership in project delivery
- Poor of stakeholder communication
- Poor competencies (and skill shortages)
- Poor stakeholder management
- Poor estimation methods
- Poor risk management
- Insufficient management support

Technical causal factors include:

- Inappropriate and ill defined software requirements
- Inappropriate technical designs
- Inappropriate development tools
- Inappropriate user documentation
- Poor test planning
- Poor technical support

Source: McManus and Wood-Harper (2007, page 39)

McManus and Wood-Harper studied 214 European public and private projects covering the period 1998-2005. They

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found that out of the 214 projects examined, 24% were cancelled. In 20% of the cases the cancellation was due to issues related to the business/organization. In 53% of the cases the cancellation was due to management-related issues, and in 27% cancellation was due to technology-related issues.

The average duration of the examined projects was 26 months, and the average budget was approx. €6M. It was found that more than half of the projects larger than €6 M ran over schedule more than 18 months and actual cost exceeded budget by more than €4.2M. This implication of size (both budget and duration) is supported by for example Sauer, Gemino and Reich (2007) as discussed earlier.

Another major cause of failure identified by McManus and Wood-Harper was the total reliance placed on methodologies. Methods can help project managers and developers, but can also become an excuse for not engaging with people and problems. An explanation for this could be lack of leadership within the delivery process. "Processes alone are far from enough to cover the complexity and human aspect of many large projects subject to multiple stakeholders, resource and ethical constraints." McManus and Wood-Harper (2007, page 43).

3.4 Preventing failure

In this chapter we will focus on literature addressing ways to avoid failures, according to our research question #3. Below, we focus on early detection of potential failure, IT projects as change journeys, risk management strategies and management principles.

Early detection of potential failure

Kappelman, McKeeman and Zhang (2006) point out that long before the failure is acknowledged there are usually significant symptoms or "early warning signs" of trouble. Their article describes the top 12 people-related and technology-related IT project risks, based on "early warning sign" data collected from a panel of 19 experts and a survey of 55 IT managers. IT project risk is grouped into three categories: people, process and product risks, and the authors found that all of the highest rated early warning signs belong to the people and the process risk categories. This resonates well with the findings of McManus and Wood-Harper (2007).

The 12 dominant early warning signs according to Kappelman, McKeeman and Zhang are listed below.

The most influential people-related risk:

- Lack of top management support
- Weak project manager
- No stakeholder involvement and/or participation
- Weak commitment of project team
- Team members lack requisite knowledge and/or skills
- Subject matter experts are overscheduled

The most influential process-related risks:

- Lack of documented requirements and/or success criteria
- No change control process (change management)
- Ineffective schedule planning and/or management
- Communication breakdown among stakeholders
- Resources assigned to higher priority project
- No business case for the project

Source: Kappelman, McKeeman and Zhang (2006)

Paying attention to these signs – the earlier in the life cycle of a project, the better – increases the probability of successful project outcome, either because they are being addressed or because the projects are being cancelled before they turn into disasters.

IT projects as change journeys

Large IT projects can often be seen as change journeys where an organization is moving from the current state to a desired state. In his famous article "Why Transformation Efforts Fail", Kotter (1995) outlines lessons learned from watching more than 100 companies' attempts to transform themselves. He presents eight critical success factors needed in order for major change initiatives to succeed. Kotter claims that too many managers don't realize that transformation is a process, not an event, and that the change process advances through stages each with their own pitfalls.

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The eight phases to successful change are, according to Kotter:

1. Establishing a sense of urgency
2. Form a powerful guiding coalition
3. Create a vision
4. Communicate the vision
5. Empower others to act on the vision
6. Plan for and create short term wins
7. Consolidate improvements and produce more change
8. Institutionalize the new approaches.

Rather than focusing on success factors in isolation, Kotter prescribes a process to follow to get the organization moving in the desired direction. Several studies have pointed out the lack of ability to manage large IT projects as one key reason why they fail, for example PASC (2011) and Whitney (2007). In the light of Kotter's paper, we suggest this has not only to do with lack of traditional project management discipline but also lack of competence in leading change journeys.

McAfee (2006) states that business leaders should not underestimate resistance when they impose changes in the ways people work. The degree of change impact drives the extent to which such change needs to be facilitated by an experienced leader. Building consensus in the organisation is important, but successful implementers are also willing to push ahead without having everyone on board when needed.

The suggestions of McAfee are very much in line with the change process outlined by Kotter. McAfee further stresses that IT project success and failure seem to be attributed more towards leadership and management aspects rather than pure technology issues, also indicated by McManus and Wood-Harper (2007) and PASC (2011).

Risk management strategies

Tesch, Kloppenborg and Frolick (2007) identify IT project risk factors that pose threats to successful project implementation. Risks are grouped into six categories and corresponding strategies for avoiding or mitigating the risks are proposed.

Risk Category	Top rated Risks
Sponsorship/Ownership	Project has inadequate top management commitment
Funding and Scheduling	Entire project must be budgeted at the outset
Personnel and staffing	Project lacks enough staff or right skills
Scope	Requirements are ignored for the sake of technology
Requirements	Project changes are managed poorly
Relationship Management	Project fails to satisfy end-user expectations

Source: Tesch, Kloppenborg and Frolick (2007, page 64)

Strategies for avoiding risks are often related to establishing project management processes within the organisation. However, other researchers warn that over-reliance on methodology can be a cause of failure in itself, as discussed earlier (for example McManus and Wood-Harper (2007)).

Another theme is the importance of recognizing the hidden risks that are difficult to avoid or mitigate in a planned fashion. Along these lines, Flyvbjerg and Budzier suggest taking a "black swan" stress test before engaging in a large technology project, as a systematic risk planning process - as suggested by Tesch, Kloppenborg and Frolick - might not be enough.

Management Principles Associated with IT Project Success

Nicholas and Hidding (2010) point out that success in IT projects remains elusive, even after decades of efforts to improve it. They argue that most of these efforts have focused on the traditional project management paradigm (for example presented in PMI (2008)) and that exploring a new paradigm called Value-Driven Change Leadership (VDCL) might be useful. The VDCL suggests tracking business value-added benefits rather than tracking conformity to plans and schedules.

The Agile Manifesto (referenced earlier) represents yet another paradigm for software development. In the Agile Manifesto Principles[3] we read "Welcome changing requirements, even late in development. Agile processes harness change for the customer's competitive advantage."

[3] http://agilemanifesto.org/principles.html

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Two schools of thought emerge here: the efficiency school and the effectiveness school. The more traditional efficiency school defines success largely by timely and on-budget delivery according to specification. In contrast, the effectiveness school promotes measurement of success according to the total project output (the value the project brings to the organization). We suggest the agile paradigm is related to the effectiveness school of thought due to its core focus on value output rather than initial scope specification.

We find no conclusive evidence as to which school of thought is the most effective in avoiding project failure (according to our definition). Rather that such an 'either-or' approach, we suggest that projects might usefully be plotted on a spectrum spanning both efficiency and effectiveness schools of thought. We will explore this contention more closely as we present the consolidated literature review analysis below.

4 DISCUSSION

The literature review reveals overwhelming evidence that IT projects in general, and large public IT projects in particular, indeed tend to fail. IT projects display an alarming rate of failure in terms of both schedule and cost overruns. Perhaps even more severely, large projects have a tendency not to deliver the promised value, and some are abandoned with a huge net loss, having failed to realize any value at all. Large scale public IT projects are typically triggered by policy reform and consequently highly visible in the media as taxpayer's money is on the line.

The literature review has revealed common core themes contributing to success and failure of public IT projects. Leadership-related issues emerge as the over-arching theme. Although proper technology strategy and implementation need to be in place, IT projects seldom fail due to technology related issues. Throughout the literature review this view seems to be a common denominator, even though each piece of literature places differing emphasis on the various leadership/management factors addressed. This is illustrated in the table below, where the main causes determining IT project failure are mapped across the literature reviewed.

Failure: Core causes	Dunleavy et al (2005, 2006)	Flyvjberg and Budzier (2011)	Kappelman, McKeeman and Zhang (2006)	Kotter (1995)	McAfee (2006)	McManus and Wood-Harper (2007)	Nicholas and Hidding (2010)	PASC (2011)	Sauer, Gemino and Reich (2007)	Tesch, Kloppenborg and Frolick (2007)	Fishenden and Thompson (2011)	Whitfield (2007)
Lack of proper leadership/management			x	x	x	x		x			x	x
Lack of change management skills			x	x	x	x		x			x	
Lack of large scale IT project management skills			x			x		x			x	x
Poor risk management strategies		x				x				x		x
Complexity, abmition and size		x						x	x		x	x
Naive and undifferntiated approach to contract and size								x			x	x
Fragmentation and poor co-ordination of joint service delivery	x							x			x	
Poor handling of volatility							x		x			
Over-reliance on methods and process						x						

Table 1 : Literature review: Core causes of failure

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We suggest that project size and volatility form a useful way to place the above findings in context. Sauer, Gemino and Reich (2007) suggest that risk of project failure increases with project **size** and **volatility**. The importance of the size factor is backed by numerous reports, including Whitfield (2007), Flyvbjerg and Budzier (2011), PASC (2011), Fishenden and Thompson (2011). The importance of proper handling of volatility is addressed in several papers, for example Nicholas and Hidding (2010), PASC (2011).

We propose analyzing project failure by applying project size and volatility as core contextual dimensions. We propose a new framework – the Contextual IT Project Famework – which is intended to (1) help strategize towards successful projects by leveraging contextually sound strategies, (2) facilitate discussions about project success and failure, and (3) frame our literature review analysis.

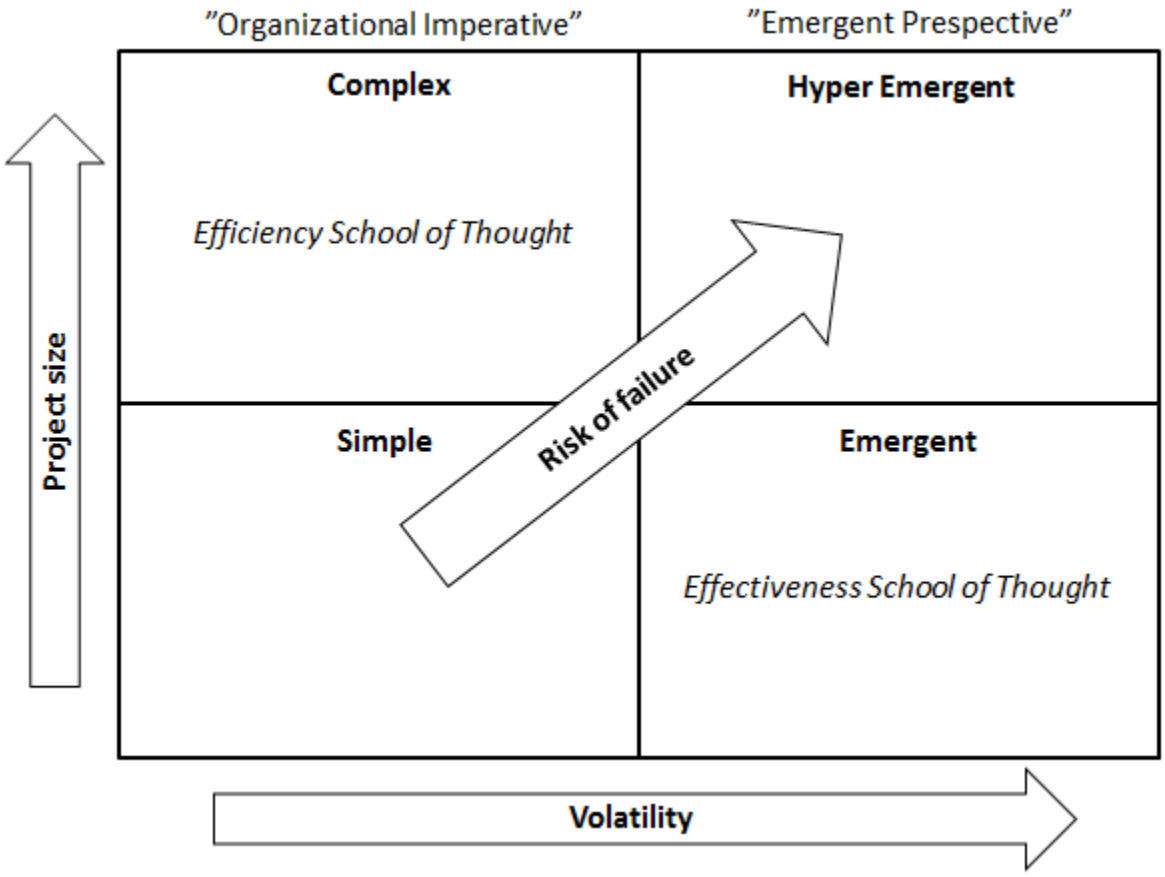

Figure 2 : The Contextual IT Project Framework

The framework maps well to the work of Markus and Robey (1988) who look at the relationship between information technology and organizational change from a causal agency point of view. They lay out three conceptions of causal agency: (1) the technological imperative where IT is viewed as a cause of organizational change, (2) the organizational imperative where designers can manage the impacts of IT systems by attending to technical and social concerns, and (3) the emergent perspective where the uses and impact of IT

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emerge unpredictably from complex social interactions.

The *organizational imperative*, which builds on the assumption of designer discretion, seems to fit well in analyzing situations where there is low degree of volatility (the left quadrants in the Contextual IT Project Framework). The *emergent perspective*, which appreciates that preferences develop and change over time and behavior is hard to predict, can be applied to the right quadrants of the Contextual IT Project Framework. According to Markus and Robey, empirical research has generated contradictory findings related to the *technological imperative*, thus we do not include this perspective in the proposed framework.

As presented in the literature review, Nicholas and Hidding (2010) discuss management principles associated with IT project success, and present two schools of thought. The traditional *efficiency school* defines success by timely and on-budget delivery according to pre-determined specifications. This traditional view of IT project management, also supported by PMI (2008), seems to apply well in projects characterized by a low degree of volatility, and is well suited for "Simple" or "Complex" projects according to our suggested framework. The *effectiveness school* of thought, which defines success according to value output rather than pre-determined specifications, seems to apply well in circumstances with higher degree of volatility.

As both project size and volatility increase, the project might end up in the "Hyper Emergent" quadrant characterized by high risk of failure. The organizational perspective fails in explaining causality in hyper emergent projects as cause and effects in high volatile environments are by nature blurred and hard to comprehend. In such situations pre-determined specifications are likely to be subject to significant change, and even with proper change control mechanisms it is likely to be a costly experience. Among the various underlying causes of failure highlighted in PASC (2011) are over-specification of requirements and a tendency to commission large projects which struggle to adapt to changing circumstances.

Based on our experience, large public projects tend to end up being "Hyper Emergent" due to vast size and high volatility in management and/or changes in schedule, budget and scope as presented by Sauer, Gemino and Reich (2007). In the existing literature we have not found any compelling holistic strategy to cope with such hyper emergent contextual situations. Pure emergent strategies, for example instantiated by the agile movement mentioned earlier, is to our knowledge not yet applied sufficiently to huge public projects. One view might be that existing emergent strategies apply well to small and volatile projects, but are not sufficient as a measure to address the needs of the "Hyper Emergent" large and volatile public projects. This view, however, needs further study to qualify.

In the absence of a holistic approach to handle "Hyper Emergent" projects, we suggest an avoidance strategy where large public projects are divided into smaller manageable pieces scattered across the contextual IT Project Framework, yet avoiding the "Hyper Emergent" quadrant. Project slices categorized as "Simple", "Complex" or "Emergent" can be addressed by well known approaches from either the efficiency- or effectiveness camp. Avoiding large and volatile projects seems to be in the spirit of Whitfield (2007), Fishenden and Thompson (2012), PASC (2011), Flyvbjerg and Budzier (2011).

Even though the Contextual IT Project Framework presents four distinct quadrants, in reality a project will find itself on a *spectrum* along the size and volatility dimensions. The diagonal risk dimension illustrated is likewise relative. Thus, even after applying avoidance strategies, a cluster of sliced projects will differ in their relative degree of being "Hyper Emergent". Therefore we suggest Flyvbjerg and Budzier's advice of performing "black swan" stress tests still applies. Also, risk mitigation strategies are highly applicable as pointed out in numerous studies such as McManus and Wood-Harper (2007), Tesch, Kloppenborg and Frolick (2007).

Based on the literature review we believe that strategies to avoid "Hyper Emergent" situations are important, yet not sufficient, in coping with public project failure. Even though we slice projects in to manageable pieces according to their risk profile, the output from the sliced projects still need to work together in a properly orchestrated symphony. This is particularly important as we move from the era of New Public Management (James and Manning, 1996) towards Digital Era Governance (DEG) where services are re-aggregated around citizens needs (Dunleavy et.al., 2006), as discussed earlier.

Thus, in a DEG world the over-arching governance of several connected projects is still going to be a key leadership challenge, even though individual projects may, as a result of the mentioned avoidance strategy, seek to move away from the "Hyper Emergent" category.

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Therefore we predict that the lack of skilled leadership capacity will remain at the centre of gravity in explaining failure of large scale IT projects. Lack of skilled IT leadership/management is reported in numerous studies to be a key reason for failure (Kappelman, McKeeman and Zhang (2006), McAfee (2006), PASC (2011).

We suggest that general leadership attributes should not be addressed in isolation; rather we suggest aiming for a combination of leadership attributes composed of skills and experience in leadership, change management (Kotter, 1995), project management (Whitfield, 2007) and large scale IT delivery (PASC, 2011). People possessing such skills are hard to find, since such skills typically are acquired by 'hard life experience' in large scale project delivery. Due to the very nature of large scale IT projects spanning several years, few people are privileged to experience more than one or two large scale project(s) over the course of their careers. Consequently, the supply of such professionals is scarce.

We submit that governments as well as companies will benefit from reflection on this scarcity. This implies new strategies to build and retain the necessary skills as well as an element of wise prioritization of the most skilled resources to the benefit of the most critical, large and complex projects. New strategies to build necessary skills can be married with our suggested approach towards slicing gigantic projects into manageable pieces paying heavy attention to risk profile, applying the Contextual IT Project Framework. In order to build the critical skills to succeed in large scale IT projects, public agencies might consider in-house delivery of low-risk components while prioritizing their (few) key IT delivery professionals towards intelligent client management of higher risk components and contracts.

As a consequence of the mentioned scarcity, public agencies typically revert to a convenient strategy of contracting out very large chunks of work, relying on contractual terms and conditions, sometimes in combination with detailed specifications. There are several flaws associated with this common strategy. First, the needs for large scale public IT delivery skills do not evaporate by outsourcing. Second, strong evidence suggests that size is a determinant of failure and work should be broken down in manageable pieces yet maintaining strong 'glue' among the pieces. Third, blending an undifferentiated mix of high and low risk components into one large contract is, according to the literature review, not best practice.

The strategy of eating the elephant one piece at a time seems logical and reasonable. However, the importance of understanding the bigger picture is still paramount. Joint IT public service delivery across agencies, and even across entities within large agencies, tends to be problematic. The importance of proper change management, common understanding of urgency, clear and shared goals, transparent status and strong focus on dependency and risk mitigation are all critical in ensuring success. Internal power struggles might undermine efficient service delivery, and the importance of a common, clear and accepted over-arching goal can not be stressed enough. This appears to be true in both open and closed architectural strategies.

To compensate for lack of skills public agencies sometimes tend to focus heavily on methodology and processes. Industrialized and optimized delivery processes are of course important, but the literature review reveals that this cannot be a substitute for the scarce leadership skills mentioned above. Over-reliance on methodology and process can lead to a dangerous false sense of control. According to the literature review, the inconvenient truth is rather a severe lack of leadership, IT delivery skills and experience on both sides of the table (clients and contractors).

As discussed, volatility is common in large scale IT projects. As projects are assessed to be leaning towards the right quadrants "Emergent" or "Hyper Emergent" of the Contextual IT Project Framework, we submit that public agencies not only should evaluate proposals based on initial price, but putting a stronger emphasis on contractual measures to ensure long term value for money. Over-reliance on up-front detailed specifications of large projects has proven not to deliver predictable outcomes as the needs are subject to change. Long-running programs might even be subject to major policy change, making initial requirements incomplete or even irrelevant.

To sum up, we propose a new framework – the Contextual IT Project Framework – which is intended to (1) help strategize towards successful projects by leveraging contextually sound strategies, (2) facilitate discussions about project success and failure, and (3) frame our literature review analysis. We suggest an avoidance strategy for moving away from "Hyper Emergent" projects, and highlight the importance of strategizing wisely in splitting large efforts into manageable pieces according to risk profile. Still, there is clearly a need for a skilled leadership, change

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management and IT delivery skills to ensure large scale IT project success. The skills are acquired largely by experience from large scale projects and we suggest new strategies to address the current scarcity of such skills, putting proper measures in place to maintain a clear view of the bigger picture. Over-reliance on contractual measures, methodology and process do not lead to the evaporation of the need of proper skills, leadership and management.

5 CONCLUSION

The primary objective of this report has been to shed light on the research questions through a focused literature review supported by our analysis. Below we revisit the research questions and highlight the main findings. Finally we will discuss limitations and suggest further research.

1. To what extent do large IT projects fail?

The literature review revealed overwhelming evidence that IT projects in general, and large public IT projects in particular, indeed tend to fail. An alarming rate of IT projects fail in terms of both schedule and cost overruns. Perhaps even more severely, large projects have a tendency not delivering the promised value and some are abandoned with a huge net loss not realizing any value at all. Large scale public IT projects are typically triggered by policy reform and consequently highly visible in media as taxpayer's money is on the line.

We found most studies reveal cost overruns in the range of about 30% (see for example Jørgensen and Moløkken (2006)). More alarming was the "black swan" effect pointed out by Flyvbjerg and Budzier (2011), reporting one in six projects had cost overruns of 200% on average, and almost 70% schedule overrun.

2. Why do IT projects fail?

We found that large IT projects seldom fail due to technology-related issues. Leadership-related issues emerge as the over-arching theme. A lack of skills in managing large scale IT projects was reported in several studies, which highlighted a corresponding tendency to rely instead on "hard" factors such as contracts and methodologies. Our study highlights the lack of skills in leading large scale IT efforts in general and change management skills in particular. Also, we found that contextual factors such as size and volatility are key determinants of failure or success. We suggest that ambitious, complex projects characterized by high degree of volatility in combination with lack of the mentioned skills, should be a cause for alarm within the public sector.

3. What can be done about it?

We suggest a new framework – the Contextual IT Project Framework – based on a conception of causal agency theory and intended to help strategize towards successful projects, paying particular attention to projects possessing what we call "hyper emergent" characteristics. Further, we propose that sustained advancement in change management and IT delivery skills is needed to ensure large scale IT project success. Such skills are acquired largely through experience of large scale projects and we suggest new strategies to address this scarcity. Over-reliance on contractual measures, methodology and process can never compensate for a lack of the aforementioned skills. We highlight the importance of strategizing wisely in splitting large efforts into manageable pieces according to risk profile and applying the Contextual IT Project Framework.

As a final remark we wonder whether the Digital Era Government (Dunleavy et al., 2006), where citizens expect aggregated services delivered across agencies, will lead to an increase in projects with emergent characteristics, where changes can no longer be handled within agency 'silos'. If so, the findings of this report in general – and the Contextual IT Project Framework in particular – will likely pay dividends for the future.

5.1 Limitations

The work presented in this paper has limitations, and further work should be done to address these.

The literature review is focused, yet representative. However, the literature review is not intended to be a presentation of the complete body of knowledge on IT project failure.

As presented in Jørgensen and Moløkken (2004) it matters whom you ask and how you collect reasons, and in complex settings like large IT projects the respondents' role, data collection approach and approach to data analysis tend to influence the conclusions. In this paper we are referencing numerous pieces of literature, but have not done a detailed comparison with regard to the above mentioned aspects.

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5.2 Future work

Further research should be aimed specifically at the "Hyper Emergent" quadrant of our suggested Contextual IT Project Framework, and we welcome empirical evidence of application of agile strategies in "Hyper Emergent" contexts.

As public projects tend to fail due to people-related issues rather than technology, we suggest further research in the lines of Orlikowski and Barley (2001) who looked at what research in technology and research on organizations can learn from each other.

We suggest further study to address the scarcity of resources possessing the proper blend of skills required to successfully manage large IT projects. Our research has provided initial evidence of what kind of skills needed, however a deep dive to add even more flesh to the bones is welcomed.

An even more comprehensive and detailed literature review covering the full body of knowledge on IT project failure is highly welcomed.

Finally, we suggest further study to address issues discussed by Jørgensen and Moløkken (2004), as discussed above. We suggest a detailed comparison of the literature reviewed in this study with regard to the above mentioned aspects.

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