Enterprise Architecture Landscape in Singapore Government Agencies

By

Ming Fai Wong

M.Sc. Computer Science
Stanford University, 2003

BS Computer Science with additional major in Economics
Carnegie Mellon University, 2001

Submitted to the **System Design and Management Program** in partial fulfillment of the requirements for the degree of

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February 2013

Signature of Author: _____

Ming Fai Wong
System Design and Management Program
Jan 2013

Certified By: _____

Jeanne W. Ross
Director and Principal Researcher
MIT Center for Information System Research

Accepted By: _____

Patrick Hale
Director
System Design and Management Program

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ABSTRACT

This paper reports results of a study done to understand the Enterprise Architecture (EA) landscape in Singapore Government Agencies, to gather some best practices in doing EA in these agencies, and to postulate how the Singapore Government might get more value out of EA. Firstly, this paper reviews the EA field on why EA is important and what are some key challenges EA practitioners face. Secondly, this paper reviews and analyzes data from a EA survey of 18 Singapore Government Agencies. The analysis is done by comparing against data from a similar survey collected from over 100 organizations worldwide. In addition, the analysis also draws upon EA research done by MIT's Center for Information System Research. Thirdly, this paper reviews best practices and a case study collected from a subset of the studied Singapore Government Agencies. This paper concludes by rounding up the key findings and hypothesizing that there is a need for stronger in-house design/architecting capabilities within the Singapore Government.

Thesis Supervisor: Jeanne W. Ross
Title: Director and Principal Research, MIT Center for Information System Research

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Executive Summary

Background – Enterprise Architecture & its Challenges; Research Motivation

Enterprise Architecture (EA), defined in this research as *a discipline that facilitates the active designing of enterprises*, is an important field because it helps organizations focus on building strategic capabilities, instead of constantly being distracted by immediate needs. Organizations report EA as benefitting them in areas such as lower costs, enhanced productivity, improved management and better risk management.

However, implementing EA is not without its challenges. This research reviewed EA literature and identified five main hurdles in implementing EA:

1. *The existence of differing understanding of what EA is*, even among experts. The key here is to establish a common understanding within the organization.
2. *Difficulty in measuring benefits of EA.* Some inherent difficulties exist plus there is no one-size-fits-all solution. A balanced scorecard approach is highlighted.
3. *Underpowered EA efforts*: EA often results in organization-level transformations. As such, top-level buy-in of EA is crucial to its success.
4. *Difficulty in building the EA Habit.* Doing EA is not a one-off effort and requires changes to existing business processes.
5. *Scarcity in good Enterprise Architects.* Good Enterprise Architects need a good balance of business and technical skills, and EA skills are better caught than taught, thus good Enterprise Architects can be hard to find.

Two questions motivated this research:

1. What is the current state of EA within the Singapore Government?
2. How can the Singapore Government get more value out of EA?

Research Approach

The research draws mainly on face-to-face interviews with 18 Singapore Government agencies, most of which with their Chief Information Officer (CIO). The research also sought out 12 other agencies that either did not get back in time or chose not to participate.

The interviews were conducted using questions from the 2011 MIT Center for Information Systems Research (CISR)[1] *Assessing Enterprise Architecture Research Survey.* The goal of that survey is to "assess the state of the art of enterprise architecture, as well as the critical management practices and business outcomes associated with enterprise architecture". It was sent to hundreds of organizations worldwide. Once the interview results had been collected, they were analyzed with CISR researchers and compared against CISR survey results.

[1] MIT CISR website, http://cisr.mit.edu/

Key Findings

Results from the survey of 18 Singapore Government Agencies (SG in short) were compared against that from the international survey (INTL in short). 32 differences were marked as being statistically significant, and these differences were grouped into four major findings for further analysis. The four major findings are:

1. **SG has more successful IT projects and more mature EA.** The result that SG has more mature EA was surprising at first, but further analysis reveal that it might be because of its strong governance processes.
2. **SG has strong governance.** Strong governance is critical to EA. SG scored higher in 15 out of 19 practices that are related to governance and EA. The remaining 4 practices of the 19 are possible areas of improvements for SG:
    a. Increase EA's influence on IT investment decisions
    b. Strengthen departmental incentives to adopt organizational process standards and shared services
    c. Formalize approach to business process optimization
    d. Establish mature Business Intelligence and Analytics capability
3. **SG outsourced significantly more – a possible indication of outflow of needed technical expertise.** A case is made in this research on how outsourcing can both benefit and hurt EA, and a key issue to watch out for in SG is the outflow of technical expertise from the organization due to outsourcing.
4. **The understanding of governance vs. design has a large gap in SG.** This might mean that governance in SG, though effective, is moving SG towards achieving short-term objectives rather than building strategic capabilities for the long-term.

Conclusion & How Singapore Government can better leverage EA

In this research, we have found that when compared to surveyed organizations worldwide (INTL), Singapore Government agencies (SG) have more successful IT projects and more mature EA. We also found that SG have stronger "Strategic Focus" and "Culture of Action-oriented Learning", and to a lesser degree are more "Process Savvy" and "Information Savvy". SG also outsourced significantly more. Another finding to note is the large gap between the understandings of governance vs. design among senior managers in SG.

Based on these findings, and taking into consideration the model where successful IT requires two key pillars—IT governance and enterprise architecture, we hypothesized that Singapore Government Agencies can strengthen its EA by building a stronger in-house architecting/design capability. We postulated that this might be achieved by revisiting outsourcing strategy to stem the outflow of technical skills from the organization. In addition, SG can also consider changing organizational attitudes and career prospects towards those skills to encourage their development.

Introduction

Enterprise Architecture (EA) is a field that has gained prominence over the past decade. The Singapore Government Chief Information Officer established an EA office a few years ago, and has been pushing for EA adoption in a number of Singapore government agencies.

A key question arising from this development is "What is the current state of EA within the Singapore Government?". In addition, another related question is "How can the Singapore Government get the most value out of EA?".

With these questions as motivation, this research was set out with three main objectives:

1. Understand the current landscape of Enterprise Architecture within Singapore Government
2. Identify best practices for Enterprise Architecture currently practiced in Singapore Government
3. Postulate how the Singapore Government can extract more value from Enterprise Architecture

Background Research

What is Enterprise Architecture?

For this research, Enterprise Architecture is defined as *a discipline that facilitates the active designing of enterprises.*

The term "enterprise" is most often referring to an organization, but it can also refer to groups of organizations (e.g. the Marriot Group) or a division within an organization (e.g. Oracle Corp. in Singapore). In this research, enterprise and organization will be used synonymously.

Like Human Resource and Finance, EA can exist as a physical department within an organization. Alternatively, it can also be a cross-departmental team that performs this function, or even an out-sourced function.

There are many definitions of Enterprise Architecture (EA), and in a later section, this issue will be discussed at greater depth as one of the challenges facing EA.

What impact should it have?

What impacts should EA have on organizations? What do EA's footprints look like? Here are answers from three authoritative sources, on tell tale signs that an organization has effective EA.

1. Clarity on Long-term Plans

The book "Enterprise Architecture as Strategy" believes that enterprise architecture help organizations focus on building strategic capabilities, instead of constantly being distracted by immediate needs. It does that by providing a long-term view of an organization's processes, systems and technologies [ix]. This clarity works hand-in-hand with strong governance to help organizations achieve future states they desire.

Following on this point, EA should also enable organizations to have clarity on current capabilities. Without this clarity, organizations end up building capabilities that they already have, or capabilities that are not supported by their existing processes, systems and technologies.

2. Strategic, Responsive and Cheap IT

CIO.com sees that enterprise architecture makes IT cheaper, more strategic and responsive, and help promote alignment, standardization and re-use of IT assets[i]. This builds on the clarity mentioned in the previous point, such that IT works on what matters, is positioned for the future and designed to maximize reuse and reduce duplication.

3. Agile

Gartner sees enterprise architecture as a change enabler "by creating, communicating and improving the key requirements, principles and models that

describe the enterprise's future state and enable its evolution." [ii]. In a way this is similar to #2, but this brings the impact beyond IT to the entire organization.

Five Hurdles in Implementing EA

If there are so many benefits to EA, why are some organizations not doing EA? There are a number of hurdles that organizations face when implementing EA. This section lists five hurdles commonly faced by organizations.

Photo credit: clappstar
http://www.flickr.com/photos/clappstar/5759395358/

Hurdle #1: Differing understanding of what EA is

"Enterprise Architecture" is big term: different people have different understanding of what it means. When the term is mentioned, some people are referring to a design (e.g. have you updated your EA?), some are referring to a discipline (e.g. I am practicing EA), and there are even a few who use it to refer to physical systems. An anecdotal example comes from my work experience: I was on a project to IT-enable an organization to improve the organization's effectiveness. My colleague asked me to "figure out the enterprise architecture", while he worked on the project objectives and getting buy-in. This was not an isolated incident, but I found many who would equate the term "Enterprise Architecture" to "complicated technical stuff" that computer software developers deal with. Not only so, even EA experts have different definitions. Table 1 lists six definitions of EA from authoritative sources. I tried to group them to tease out similarities, but they still look different from one another.

Source	Definition	Objective of EA	Process or Design, and Key Elements
Gartner	The process of translating business vision and strategy into effective enterprise change by creating, communicating and improving the key requirements, principles and models that describe the enterprise's future state and enable its evolution.[ii]	Realize business vision	Process: Create, Communicate, Improve Key requirements, principles and models
MIT's Nightingale and Rhodes (on Enterprise Architecting)	Applying holistic thinking to design, valuate and select a preferred structure for a future state enterprise to realize its value proposition and desired behaviors.[iii]	Realize business vision	Process: Design, Valuate, Select Structure
MIT Center for Information System Research	The organizing logic for business process and IT capabilities reflecting the integration and standardization requirements of the firm's operating model.[iv]	Realize business vision	Design Business process and IT capabilities
The Open Group Architecture Framework (TOGAF) version 9.0 (on Architecture)	A formal description of a system, or a detailed plan of the system at component level to guide its implementation; and the structure of components, their inter-relationships, and the principles and guidelines governing their design and evolution over time.[v]	Guide system implement ation	Design Component level plan, Structure, Inter-relationships, principles
John A. Zachman	The total set of intersections between the Abstractions and the Perspectives that constitute the total set of descriptive representations relevant for describing an Enterprise.[vi]	Describe an enterprise	Design Abstractions, Perspectives
Institute For	About understanding all of the	Describe	Process:

Enterprise Architecture Developments (IFEAD)	different elements that go to make up the Enterprise and how those elements inter-relate.[vii]	an enterprise	understand Elements, Inter-relationships

Table 1 EA Definitions from Various Sources

Reasons for Difference

I see two main reasons for the different understanding and definition. Firstly, architecture is not a simple concept. A quick look at the definition of "Architecture" on Wikipedia showed six definitions[viii], and like the term "Enterprise Architecture", it can refer to a design, a discipline or a physical object. Furthermore, many different words can be used to describe EA's key elements. The definitions in Table 1 used these words: Key requirements, structure, perspectives and inter-relationships. Secondly, Enterprise Architecture came out from IT, thus it is often confused with IT system architecture, relating back to the earlier point that people equate the term to the ill-defined concept of "complicated technical stuff". The confusion is worsened by the fact that EA is often used to solve IT system related issues, as IT systems have become ubiquitous in business environments and they are often complex and difficult to understand.

Definition of EA for this research

I believe there is no one correct definition of Enterprise Architecture. What is more important for an organization is to have a *common* definition within the organization, because without that, it is very difficult to form a common goal to build towards and thus making it hard to implement EA.

For this research, Enterprise Architecture is defined as *a discipline that facilitates the active designing of enterprises.* And as mentioned earlier, "enterprise" and "organization" will be used synonymously.

Hurdle #2: Measuring benefits of EA

Why is it so hard?

The book "Enterprise Architecture as Strategy" identified five areas where EA benefits are evident: "IT costs, IT responsiveness, risk management, managerial satisfaction, and strategic business outcomes".[ix] United States' Government Accountability Office (GAO)'s 2002 survey of government agencies yielded similar findings: Lower costs, enhanced productivity, improved management and greater interoperability.[x] Is it not sufficient to simply measure for these benefits?

The challenge is that these benefits often cut across departments and business units in an organization; individual departments might take credit for those benefits. For example, EA might have resulted in greater clarity into an organization's processes,

allowing departments to more easily streamline its own processes. A department can take credit for its improved effectiveness and the benefits of EA would go unaccounted for.

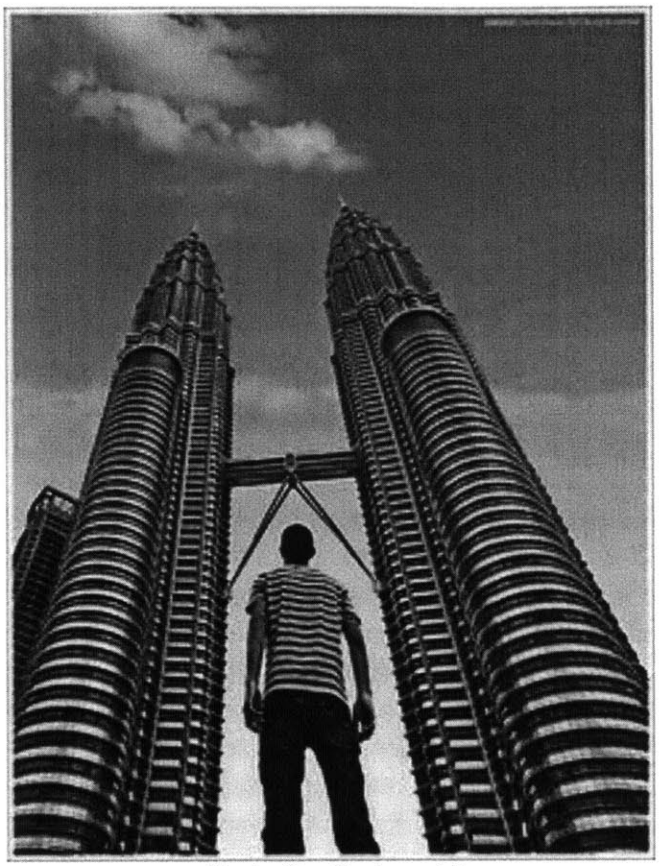


Photo Credit: danorbit
http://www.flickr.com/photos/danorbit/1976880927/

Secondly, some EA benefits take more time to show. "Enterprise Architecture as Strategy" described EA as building an organization's "foundation for execution"; rightfully, a good foundation will only show its worth when the storms set in, which does not always happen immediately. As such, organizations looking for immediate results might give up on their EA efforts before their efforts can deliver benefits. However, I believe there are ways to structure EA efforts such that they deliver both short term and long term benefits. "Enterprise Architecture as Strategy" shares the same viewpoint, encouraging organizations to build their EA one piece at a time, instead of doing a big-bang tear down and rebuild which is both risky and costly. This requires a conscious embedding of EA efforts into existing projects.

Thirdly, some EA benefits are less tangible, for example greater clarity, coherence within the organization or more knowledge sharing. In one of my past EA exercises, my colleagues and I were creating the future state of an enterprise, and as part of that work we interviewed many stakeholders of the enterprise. What we realized

was the interview process gave people a sense of involvement in the transformation exercise, and that helped to make the later implementation of change easier.

Lastly, there might not be a one-size-fits-all benefits metric. The reason is EA is about facilitating the design of an organization, so the success of EA is how well it helps move the organization towards that design. If the design is for the organization to be more profitable, then measure profitability. If the design is for greater customer satisfaction, then measure that. It does not make sense to measure profitability when the organization is designing for greater customer satisfaction.

Suggested Approaches

A good approach to measuring benefits of EA is to incorporate the identified benefit areas into a balanced scorecard, similar to the one described in Nick Malik's article "How do you measure Enterprise Architecture?"[xi]. Nick proposed including not only profitability or cost savings on the scorecard, but also other aspects such as feedback from various business units on their view of EA, and the number of EA deliverables produced. This approach helps to provide a more holistic view on the impact of EA in the organization. Via Nova Architectura's paper "A balanced scorecard approach to measure the value of enterprise architecture" provides further suggestions on how the scorecard can look like[xii].

Separately, PwC principals Chris Curran and David Baker suggested a few EA quick wins that will help organizations deliver EA's value early[xiii]. Their suggestions include embedding Enterprise Architects into projects to help those projects succeed and focusing EA on a high priority business domain or a core IT capability.

Approach for this research

For this research, we will focus on business outcomes. We included a section on business outcomes in our survey to identify correlations between EA practices and business outcomes. Some examples of business outcome information we collect are "percentage of IT projects that achieved their intended business objectives" and "customer service in comparison to competitors".

Hurdle #3: Under-powered EA Efforts

Imagine that: your boss gives you new responsibilities but not the necessary powers!

Picture from http://www.mytractorforum.com/showthread.php?t=26830

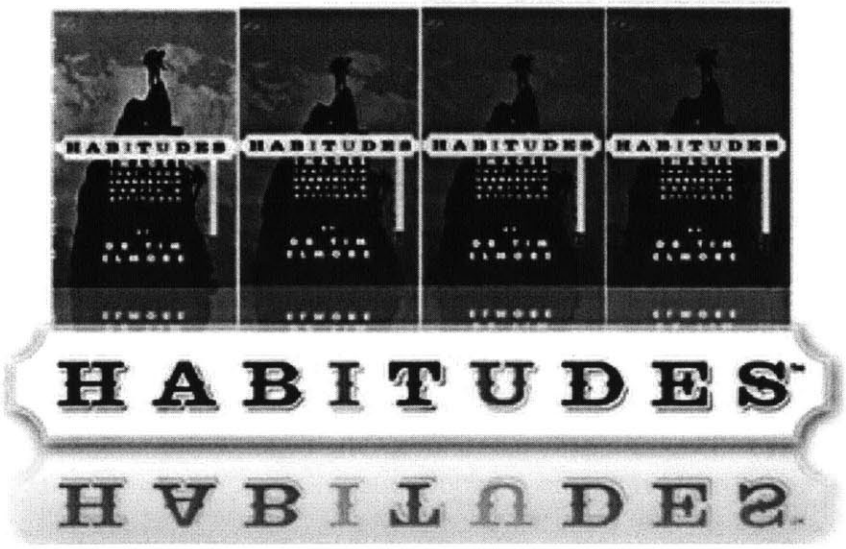
EA champions are tasked with facilitating the design/re-design of an organization. Often, a new design requires major changes in the organization, and these changes will only happen if EA champions have the needed influence to set the change in motion and the organization has the necessary structures and governance to see through the change. For example, an organization might realize that knowledge about its customers resides in a handful of very experienced employees. When these employees retire or resign, the organization experiences a major loss in customer knowledge. Consequently, the new design of the organization includes a regular process for employees to share their knowledge with other employees. However, without the right level of enforcement of the new process, the new design will remain only as an idea. The organization needs a way to monitor compliance to the design, and a way to encourage compliance and deter non-compliance.

The level of empowerment might be correlated with how high up EA champions sit in organization charts. In talking to numerous CIOs, I got a general sense that the successful EA efforts were in organizations where the EA champions either reported directly to the CEO or were one level down in the hierarchy, whereas the less successful organizations have EA champions that were hidden a few more layers down. However, this is not always the case. We will discuss this more in the later section "Where the Chief Architect sits does not matter?"

Not only does the "reporting distance" from the CEO reflect the organization's beliefs on the usefulness of EA, but it also impacts the difficulty for EA champions to facilitate change. EA champions need visibility of the organization at the senior management level to ensure that designs are aligned to senior management's thinking. EA champions will also need sponsorship from senior management to push through required changes. Being part of or close to senior management will make EA champion's task easier.

Hurdle #4: Building the Enterprise Architecture Habit

I was at a conference last year and one presentation showcased wonderful Enterprise Architecture (EA) work an organization did. The organization mapped out their high level strategies, linked it to their business functions, and identified linkages between various parts of their organization. They had created useful documentations for understanding the organization, and how different parts were inter-related. Obviously the organization invested tremendous effort in creating this information. "How do you keep this information updated?" an audience member asked. There was a pause; seemingly the question hit the nail on its head. The presenter then honestly shared that keeping the architecture updated was one of the greatest challenges his organization faced in their EA work.



Habitudes, a popular book on leadership habits and attitudes
http://growingleaders.com/habitudes/

Don't get me wrong: I do not believe that Enterprise Architecture should just be about drawing diagrams or maintaining documentations. These activities are important, but more important is making sure that people use the created information.

The key is that for Enterprise Architecture to be useful and sustainable, it needs to be ingrained into business-as-usual processes. Governance processes might use the

enterprise architecture to guide decision-making; project plans might include a step to update enterprise architecture documents. Doing this requires changing the way people do things, and changing behaviors is often difficult. It is akin to cultivating a new habit, and that is why I titled this hurdle "building the enterprise architecture habit".

For example, consider the example encountered by the conference speaker. Organizations are constantly changing. Updating documentations creates additional work, and is not what many people will naturally do. Moreover, the beneficiary of the information is often not the information provider himself, so there are some imbalances in incentives. This problem is further enlarged in large organizations, as there is more information. As such, without ingraining update of EA documents into existing processes, EA documents will become less and less accurate as time goes by. Organizations need to put into their governance controls such that major changes in the organization are updated into EA documents in a timely fashion. More importantly, organizations need to make sure the EA documents are used in decision-making on a regular basis, because that is the best way of ensuring that the information will be kept up-to-date!

Another manifestation of the same problem is EA consultancy projects that produce stacks of documents and drawings that nobody uses. This is a related problem, in that it is in part caused by the lack of an enterprise architecture habit. What is different here is that this situation is also plagued by the "not invented here" syndrome: The users of the information are often not the ones who produced them. Likely, it is external consultants who created those stacks of paper. Consequently, the information is not used because people do not trust it, are not familiar with it or even are not aware of its existence.

The challenge for organizations is thus cultivating a habit, and putting in the necessary rewards and controls, to update and use EA information.

Hurdle #5: Where are the good Enterprise Architects?

CIO.com listed a myriad of characteristics that enterprise architects should have: solid technology knowledge, good business acumen, wide perspectives, deep customer and business knowledge, visionary but yet pragmatic[xiv]. It is not easy to hire somebody with all these traits!

Photo credit: solidether
http://www.flickr.com/photos/solidether/1084349065/

Over the course of my work, I have not met many really good enterprise architects. To begin with there are not many EA practitioners because EA is still a relatively new field. Furthermore, there are people who have the EA certifications and maybe even relevant experiences, but tend to be too theoretical, or do not truly understand EA, or do not have the personal influence to effect changes EA brings. Sometimes it is not the enterprise architect's fault that he cannot effect necessary changes, as in the case mentioned earlier about underpowered EA efforts, but I believe successful enterprise architects still need an above-average level of personal influence.

Moreover, it is not easy to train existing employees to do EA. Firstly it is not easy to find people with the traits mentioned earlier of enterprise architects. Secondly, similar to skills like project management and negotiation, EA is learnt more by doing than studying. Shadowing an experienced enterprise architect in his work is an excellent way to learn, but for organizations that have not started EA efforts, where can they get the experienced enterprise architect? Thirdly, EA is often given as additional responsibilities to existing employees. It is obviously challenging for them to deal with learning EA on top of their existing responsibilities.

Where do we go from here?

With the understanding of common hurdles faced by organizations in implementing EA, we studied a number of organizations to understand where they were in their EA journeys, and what practices helped them mature in EA. In particular, the study was focused on Singapore government agencies, on how they can better leverage EA to meet their organizational objectives.

Research Methodology

The research draws mainly on face-to-face interviews with 18 Singapore Government agencies, most of which with their Chief Information Officer (CIO). The research also sought out 12 other agencies that either did not get back in time or chose not to participate.

The interviews were conducted using questions from the 2011 MIT Center for Information Systems Research (CISR)[2] Assessing Enterprise Architecture Research Survey. The goal of that survey is to "assess the state of the art of enterprise architecture, as well as the critical management practices and business outcomes associated with enterprise architecture". It was sent to hundreds of organizations worldwide[xv].

Once the interview results had been collected, they were analyzed with CISR researchers and compared against CISR survey results.

Selection of Agencies

There are over 80 government agencies in Singapore. This research selected agencies based on the follow criteria:

1. Representation from all the different ministries in Singapore government. 9 out of 16 ministries are represented. In addition, perspectives from whole of government, national healthcare and organs of states are also included. Unrepresented ministries are:
    a. Ministry of Transport
    b. Ministry of Culture, Community and Youth
    c. Ministry of Social and Family Development
    d. Ministry of the Environment and Water Resources
    e. Ministry of Home Affairs
    f. Ministry of Trade and Industry
    g. Prime Minister's Office
2. Representation from both large and small agencies
3. Representation from both agencies whose Information Technology (IT) is managed by Infocomm Development Authority of Singapore (IDA) as well as those that are not. A key role of IDA is as the government's Chief Information Officer (CIO). In that role, IDA manages the IT function of over 40 government agencies in partnership with those agencies. Having representation from both camps is important as IDA is my sponsor organization and it would be interested to know about peculiarities (if any) of the agencies it support.

The table below shows the list of selected agencies and how they fit with regards to the selection criteria.

[2] MIT CISR website, http://cisr.mit.edu/

Agency	Ministry	IDA managed?	Number of Employees (approximate as of Nov 2011)
Whole of government	N.A.	Yes	125,000+
Defence Science and Technology Agency (DSTA)	Defense	No	3,000+
Ministry of Defence	Defense	No	30,000+
Ministry of Education	Education	Yes	36,000+
Inland Revenue Authority Of Singapore (IRAS)	Finance	No	2,000+
Singapore Customs	Finance	Yes	800+
Ministry of Foreign Affairs	Foreign Affairs	Yes	1,000+
Health Promotion Board (HPB)	Health	Yes	900+
Ministry of Health	Health	Yes	600+
National Health (MOHH)	Health	Yes	1,250+
Infocomm Development Authority Of Singapore (IDA)	Information, Communication and the Arts	Yes	1,500+
Ministry of Law	Law	Yes	400+
Central Provident Fund Board (CPFB)	Manpower	Yes	1,600+
Ministry of Manpower	Manpower	Yes	1,600+
Singapore Workforce Development Agency (WDA)	Manpower	Yes	550+
Housing And Development Board (HDB)	National Development	No	5,300+
Urban Redevelopment Authority (URA)	National Development	No	1,000+
Attorney-General's Chambers (AGC)	Organ of state	Yes	400+

Findings: Differences between Results from Singapore Government Survey and International Survey

Results from the survey of 18 Singapore Government Agencies (SG in short) were compared against that from the international survey (INTL in short). The international survey responses had 146 organizations, with the smallest organization having 980 employees, and included well-known companies from numerous countries in varied industries including finance, transportation, energy, software and government.

32 items were identified as having differences that were statistically significant. Annex A shows a summary of these 32 items. A discussion on the key differences entails. The discussion begins with the bottom-line—business outcomes—before moving into three major themes that may explain the differences in business outcomes, as well as highlight some possible future focus areas for SG.

Additional details on the survey results can also be found in Annex C.

Business Outcome: SG has more successful IT projects and more mature EA

On average, SG has 23% more successful IT projects than INTL. See Figure 1.

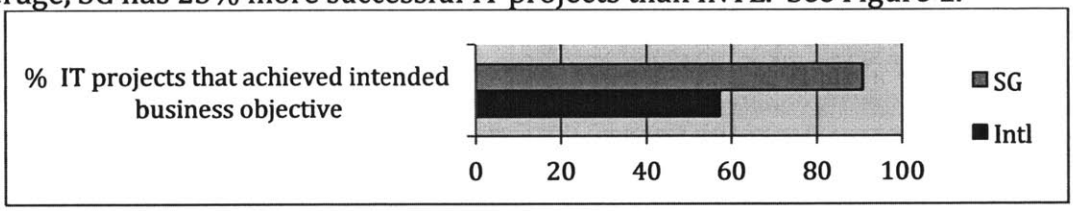


Figure 1 % IT Projects that achieved intended business objectives

And SG, on average, is more architecturally mature. MIT CISR has developed a maturity framework that defines 4 stages of architecture maturity—business silos, standardized technology, optimized core, business modularity. It has found that organizations get increasing strategic business value from IT as they mature according to this framework, as shown in Figure 2. SG self-reports, on average, to be stage 3 – business optimization (also known as optimized core), higher than INTL who self-reports to be at stage 2 – standardized technology.

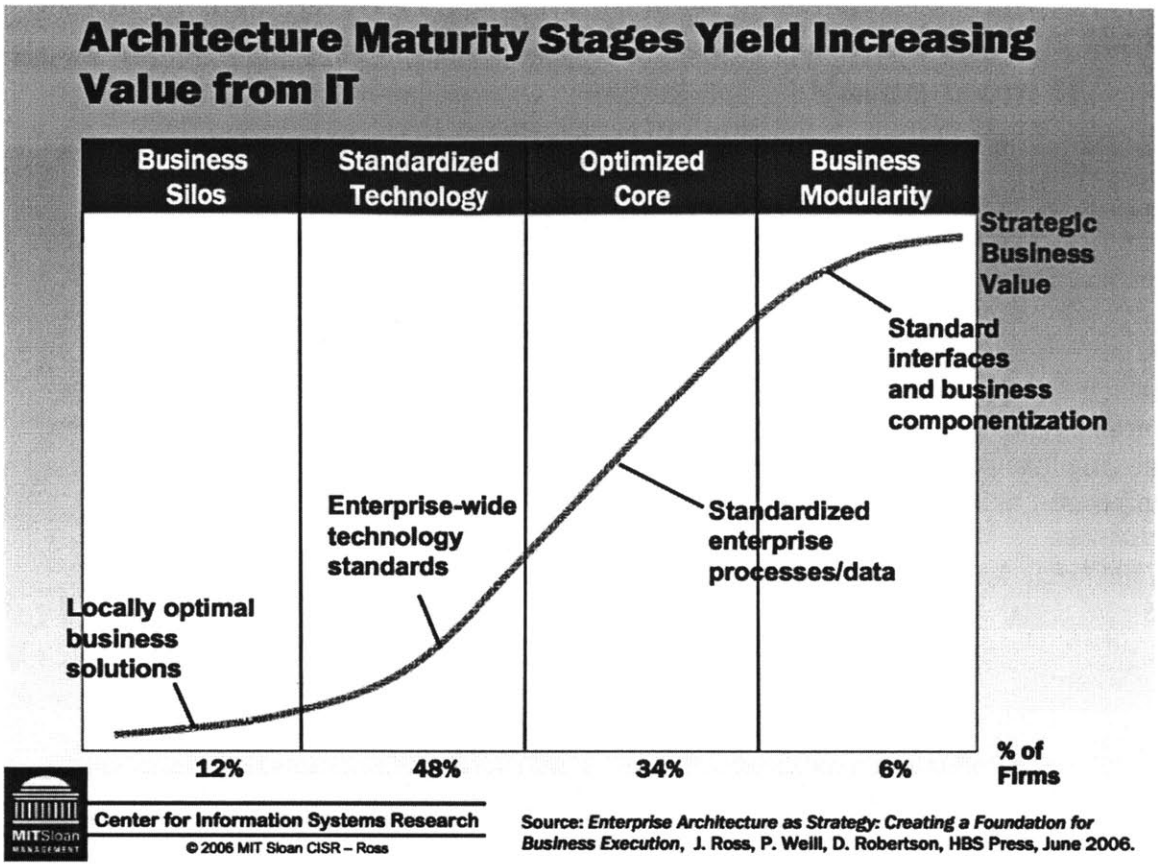


Figure 2 MIT CISR's EA Maturity Model

Why the lead in this area?

This finding surprised me initially. This is because when I started with this research, I expected SG to be less mature in its EA practice as many agencies I interviewed were just starting out or have not yet started on EA.

However, one of the interviewed CIOs told me this finding was in line with his experience work as regional CIO for a multinational company. Moreover, as discussed in the subsequent sections, it might also be because of SG's stronger governance and outsourcing practices that are helping SG focus on what is really important, and thus have a better handle on their Enterprise Architecture compared to private companies.

Furthermore, I might also have had too high an expectation of the EA maturity of organizations worldwide. Having read many descriptions on organizations with successful EA, I might have skewed my perception of reality. Thinking back on the startup and multinational company that I have worked in before, things there were not superbly structured when compared to the government, so this finding becomes more plausible on hindsight.

Separately, this finding supports the finding in CISR research, that organizations with more mature EA have better business outcomes.

Theme 1: SG has Strong Governance which sets a Good Foundation for Mature EA
MIT's Center for Information System Research identified four enterprise-wide characteristics that are critical for identifying architecture maturity. From the survey data, SG exhibited these characteristics more strongly than INTL, and this might be a key reason for SG's more mature EA and better business outcomes.

Table 2 shows the four characteristics and how they are defined.

Table 2 Definition of two of four Enterprise-wide Characteristics correlated with architecture maturity (source: CISR research)

Enterprise-wide Characteristic	CISR Definition	Why it matters
Strategic focus	Consistently identifying business targets for IT-related initiatives and assigning accountability to appropriate persons	Strongly correlated with innovation, time to market and customer service.
Culture of action-oriented learning	A habit of designing learning opportunities from IT initiatives and implementing change based on the learning. Transparency is at the heart of this learning.	Strongly correlated with business efficiency, innovation and time to market
Process Savvy	Knowing how to define, implement, standardize, optimize repeatable business processes	Correlated with business outcomes, though the other three characteristics are stronger predictors of business outcomes.
Information Savvy	Knowing how to use digitized information to make decisions and get work done	Correlated with customer service and external collaboration

In addition, each of these characteristics was quantified using scores of four to five associated practices in the survey. In total, there were 19 practices. SG scored higher in 15 of these 19 practices when compared to INTL. Figure 3 to Figure 6 shows SG's score for these 15 practices, grouped by characteristic.

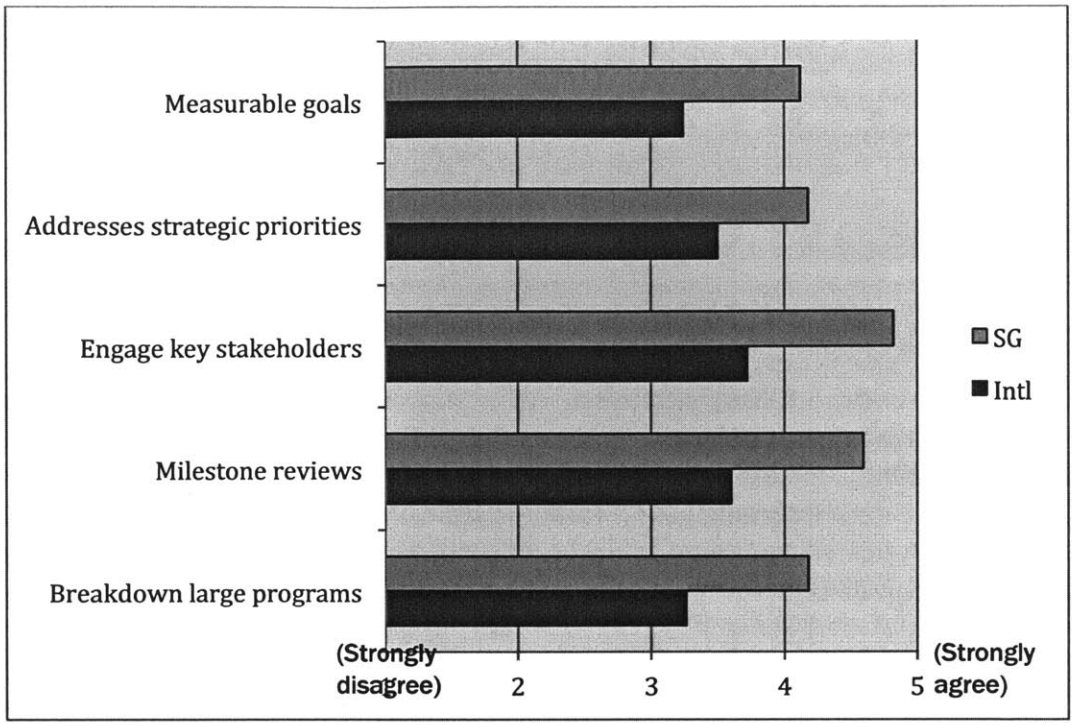


Figure 3 "Strategic Focus" Scores (self-rated)

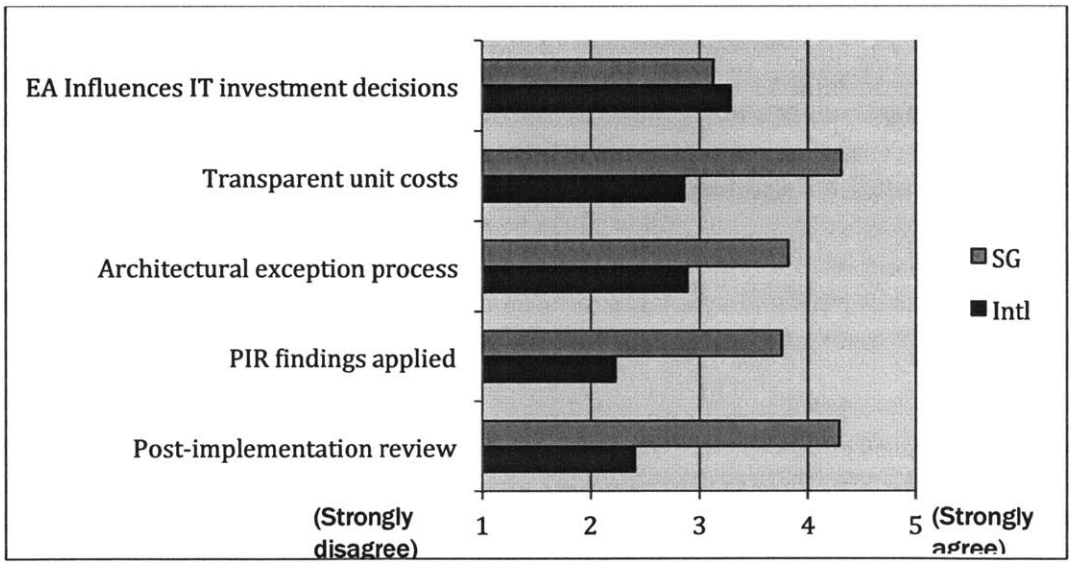


Figure 4 "Culture of Action-oriented learning" Scores (self-rated)

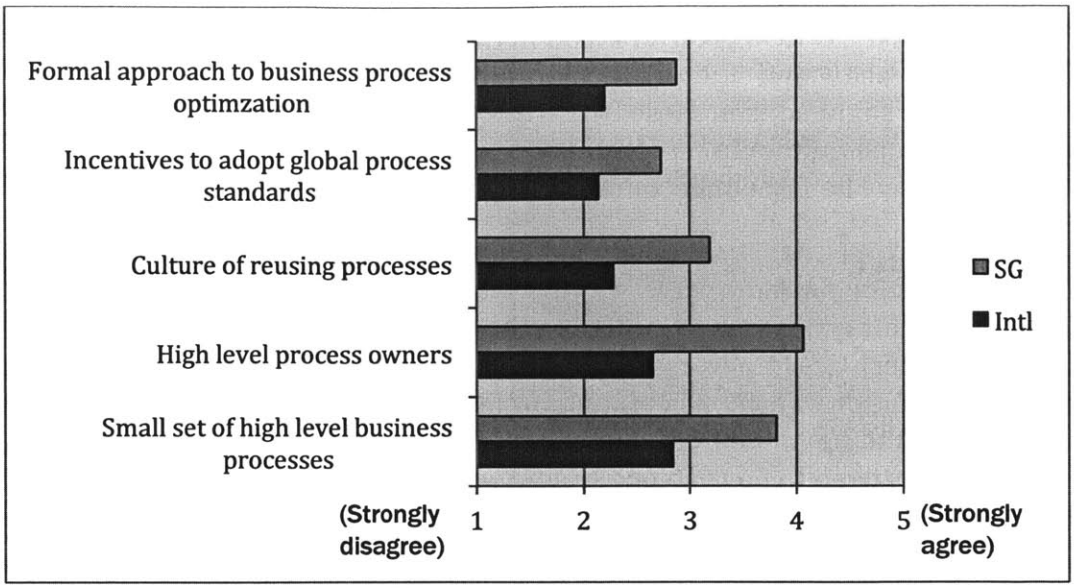


Figure 5 "Process Savvy" Scores (self-rated)

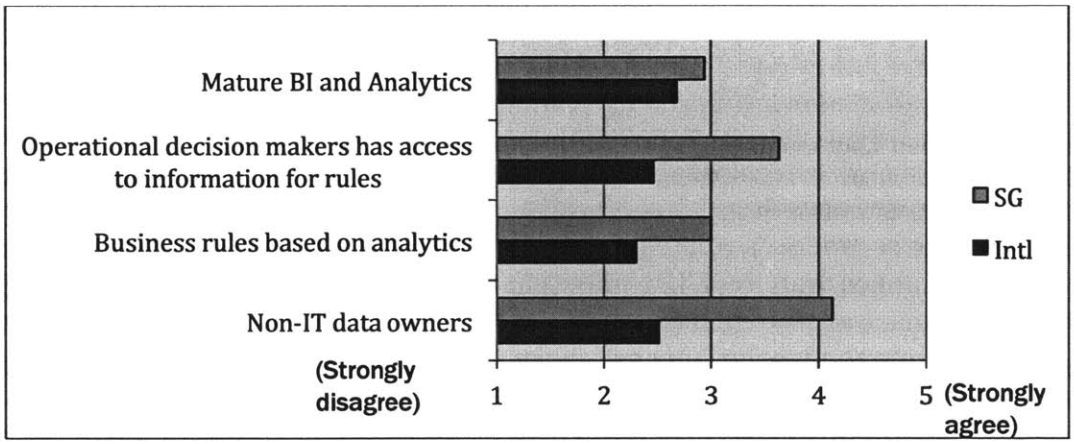


Figure 6 "Information Savvy" Scores (self-rated)

Why the Lead in these characteristics?

The findings for "Strategic focus" and "Culture of action-oriented learning" were not surprising to me, as these practices are mainly governance processes and I have known Singapore Government Agencies to have strong governance processes. I have heard a similar comment from people who have worked in both the private sector and the public sector, and the comment was that public sector organizations are more structured (some seeing that as red tape). In addition, these organizations have been around for a while so they had the needed time to setup required control structures and practices. Last but not least, government organizations tend to have stronger controls to provide clear accountability of how taxpayers' money was spent.

Results in "Process Savvy" and "Information Savvy" were more surprising, as I had not seen much enterprise-wide adoption of practices such as process reuse and

business analytics. However, SG's lead in this two areas were not as strong as that in "Strategic focus" and "Culture of action-oriented learning", so it might just mean that SG has a slight edge in these two areas. In any case, to better understand this edge, I did some follow-up research and found a number of best practices SG use that might have help them become "Process Savvy". See the later section on "Best Practices".

Good Foundation for Mature EA

What this finding means is that SG organizations are stronger in the four enterprise wide characteristics important for architecture maturity. This provides SG with a strong foundation to establish mature architectural practices. This is consistent with CISR's finding in the INTL survey. It is also consistent with my belief that organizations need to have strong governance processes in place in order to have mature EA. Good governance is needed so that changes to existing processes and data are channeled through a common approval body. How can any organization standardize unless all changes and new initiatives are checked against standardization requirements? In the organizations I studied that had mature EA practices, all of them had strong governance in place. The Enterprise Architecture team was involved in approving new business initiatives, to ensure that the initiatives are not deviating from the organization's standardization and integration vision. Without such a governance framework in place, standardization and integration are just talks that have no teeth to be realized.

Possible Future Focus Area

There are four practices related to the enterprise-wide characteristics in which SG was not stronger than INTL (Do note that though SG might score higher in some of these practices, as shown in the earlier charts, the differences are not statistically significant due to high variances of those scores). These are possible areas of improvement for SG.

- Enterprise architecture influences IT investment decisions (related to culture of action-oriented learning)
- Business unit incentives to adopt global process standards and shared services (related to Process Savvy)
- Formalized approach to business process optimization (related to Process Savvy)
- Mature BI and analytics capability (related to Information Savvy)

Theme 2: SG outsourced significantly more.

On average, SG's outsourced budget is at least 40% more than that of INTL's, for both build (development) and run (operating) budgets. Figure 7 shows the % budget outsourced for SG and INTL.

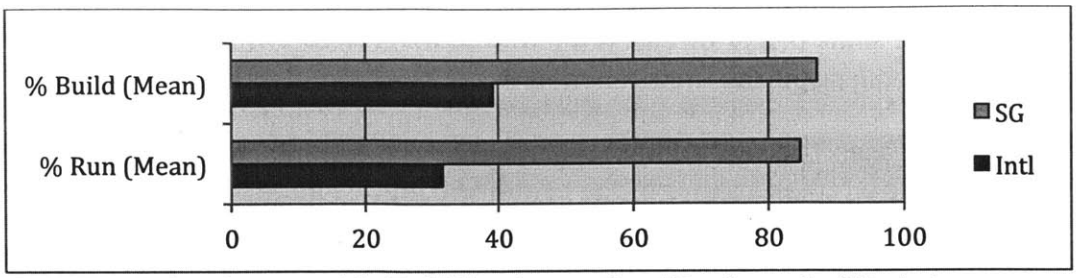


Figure 7 % Budget Outsourced for Build (development) and Run (operating) Projects

Outsourcing and EA Maturity

The main question that SG should be concerned about following from this finding is: How does outsourcing impact Enterprise Architecture maturity?

In a number of agencies I interviewed, I observed that most—if not all—of the IT work was outsourced, so the IT staff's main role was managing the contracts and vendors responsible for implementing and operating IT systems. I also got a sense that these IT staff had heavy workload. Drawing from these observations, my hypothesis was that the IT staff at these organizations neither had the capacity nor the required skillsets to do EA, since their focus was mainly on vendor management. As such, I expected the EA maturity of those organizations to be low. My mental model of the situation is depicted in the system dynamics model in Figure 8.

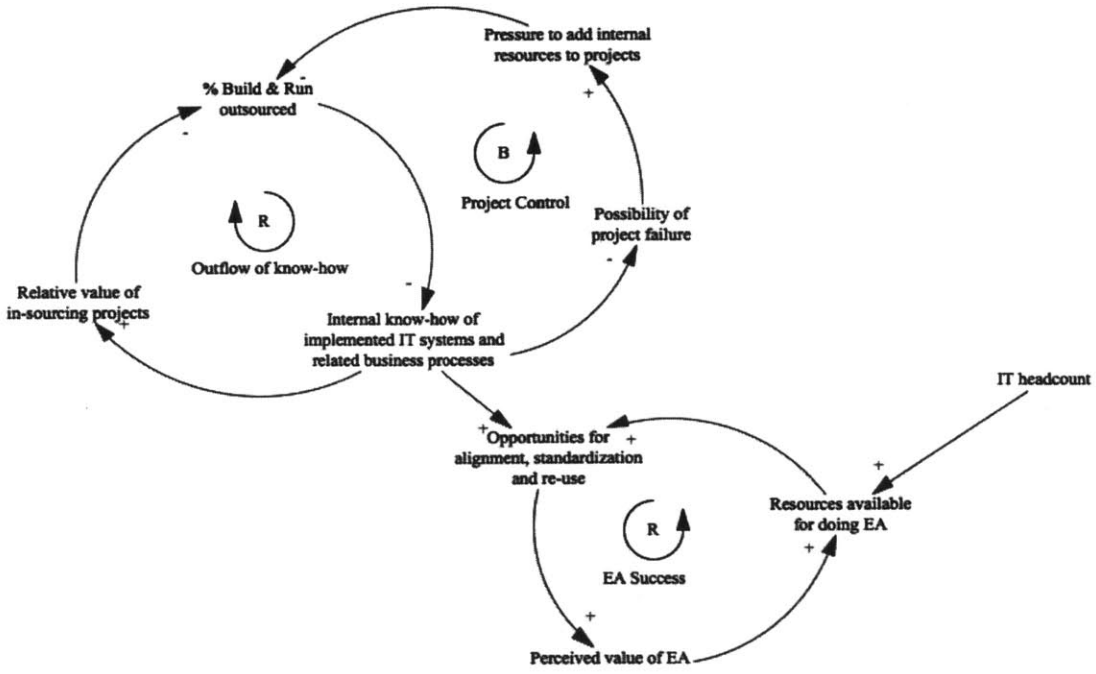


Figure 8 Hypothesis of why organizations do not do EA

A quick note on notation: Here an arrow linking two items means a change in the first item results in a change in the second item. A "+" on the arrow means the

change will be in the same direction (i.e. if the first item increases, the second item will increase; and similarly, if the first item decreases, the second item will decrease). A "-" on the arrow means the change will be in the opposite direction (i.e. if the first item increases, the second item will decrease; and similarly when the first item decreases). The circular arrows in the center are merely annotations. They indicate the items surrounding them forms a loop (e.g. % Build & Run outsourced, Relative value of in-sourcing projects, and Internal know-how forms a loop). There are two types of loops: R for reinforcing, and B for balancing. Reinforcing loops are what we commonly know as positive and negative spirals. When one of the items in the loop increases, it causes changes to other items in the loop such that eventually it will increase more and more unendingly. Similarly when one of the items in the loop decreases, it can also spiral downwards unendingly. Balancing loops, in comparison, are stable. They will get all items in its loop to stabilize to a particular value and stay at that equilibrium.

Coming back to my mental model. I started with the top left part on % Build & Run outsourced. As more work is outsourced, the internal know-how of implemented IT systems and their related business processes decreases. Since these is not much internal know-how, the relative value of doing projects internally decreases, and consequently more work is outsourced. This dynamic is observed in the interviewed agencies. Firstly, as mentioned earlier, many agencies only have contract/vendor managers, so internal know-how of implemented IT systems and related business processes might be down to a bare minimum. Secondly, many of the interviewed agencies use government wide systems for tasks like finance, human resource and procurement. Even though these systems can be seen as in-sourced since they are provided by the government, they are out-sourced from the organization's perspective, and organization's IT knows little about the IT system design, their related business processes and data.

As such, the incentives for insourcing more of the building and running of those systems are small, since the organizations neither have the headcount nor the skillsets required to design and build those systems.

This spiral of outsourcing more can go on infinitely, if not for the "Project Control" balancing loop. Here, lower internal know-how increases the possibility of project failure, as the customer becomes more at the mercy of the vendor. This increases the pressure to put more internal resources to projects to keep an eye on what is going on and prevent being held hostage by the vendor. Consequently, the amount of work outsourced is prevented from going to 100%. The balance in government agencies seemed to be struck at just having enough contract managers to manage the contracts and vendors.

The key is revealed in the next loop. As the internal know-how decreases, opportunities for business-IT or business-business alignment decreases, resulting in lower perceived value of EA. This results in less resources allocated to EA, further lowering opportunities for EA to prove its value. Lastly, this dynamic is also

impacted by the number of headcounts available for EA, which often depends on the IT headcount.

If this reasoning is correct, then it suggests that greater outsourcing will make it more difficult to have mature EA.

Implications for SG

Does this mean that there is a need for SG to invest more in EA resources, and possibly consider insourcing some IT development work?

But investing in the wrong resources will also not help (people who just draw diagrams). Or investing in resources but not utterly convincing the CEO will not help either (see section on "Where the CIO sits does not matter?"). Moreover, there is no support in the survey data on the relationship between EA maturity and the size of the IT department, possibly because the size of the IT department (relative to the size of the company) is dependent on industry (e.g. very high for financial companies, but very low for manufacturing companies, so probably a similar dependence exist for SG), and how well an organization outsource.

It may then boil down to outsourcing well. Outsourcing well might help organizations focus on the more important aspects of their organization, which in turn help their EA efforts. In the reverse direction, strong EA help organizations outsource well. An organization with mature enterprise architecture might have that "strategic focus" and outsource only its non-core functions, minimizing impact on their enterprise architecture. In addition, EA can help outsourcing decide what internal know-how to retain to ensure that vendors do not just build random capabilities but are delivering capabilities in alignment to the enterprise architecture.

However, it is important to note that following the earlier reasoning, the likelihood of losing key internal know-how is still higher with greater out-sourcing. Thus this is a risk that organizations that outsource heavily need to keep track of.

Possible to have Greater Outsourcing and More Mature EA?

Another puzzling issue is that given the earlier reasoning that greater outsourcing makes it harder to have mature EA, then how can one explain the higher maturity of SG's EA? It might be because SG outsource in a smart way, allowing them to not be tied down by nitty-gritty details but have strategic focus, and at the same time retain key know-how to ensure alignment to their EA.

Separately, in the SG organizations with more mature EA, I noticed they all have internal resources dedicated to EA. In addition, there are some of them who, unlike the other SG organizations, have larger in-house IT development and operations teams. There are thus anecdotal evidences that insourcing some IT work and devoting more resources to EA help in an organization's EA maturity.

Theme 3: The understanding of governance vs. design has a large gap in SG.
The gap between the percentage of senior managers who could describe IT governance and those who could describe high-level enterprise architecture was great in SG. This gap is especially prominent when compared against a similar but smaller gap for INTL. See Figure 9.

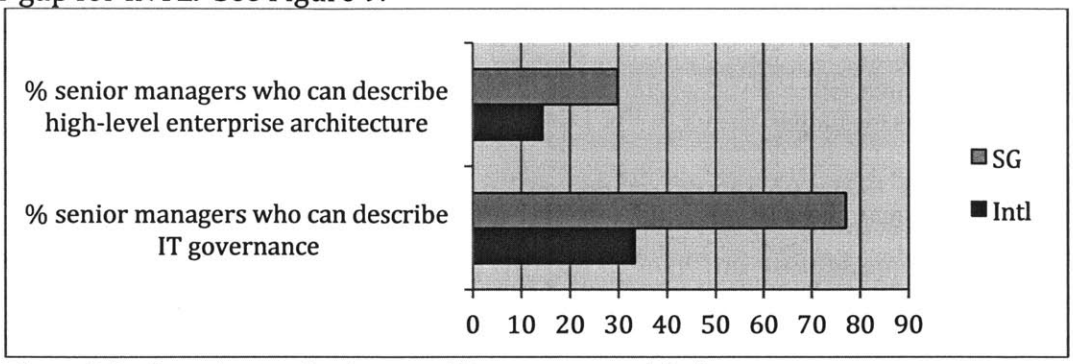


Figure 9 Gap in understanding between IT governance and design

Is this gap a problem? One question that jumps out is: if senior managers can describe their organizations' IT governance, but not the high-level enterprise architecture, then what are they governing against? Especially if one agrees with the analogy that enterprise architecture is akin to urban planning, and the high-level enterprise architecture is the high-level zoning blueprint of a city. Following this analogy, senior executives of the city need to have a common blueprint, for if not the undesirable developments such as a factory built next to a kindergarden might occur unknowingly. Several of the CIOs I interviewed gave me puzzled looks when they were asked about their organizations' high-level enterprise architecture. They were not sure what it was referring to. Given this observation and the survey findings, are senior managers simply governing the cost and schedule of projects, but not the scope? The blueprint can help senior managers decide if the planned scope is inline with the organization's plans. It seems unlikely that senior managers are not governing the scope of projects. Maybe they govern scope using an intuitive sense of what is needed and not needed in the organization? If that is case, is this akin to city executives developing the city with an intuitive sense of the zoning blueprint?

More fundamentally, is it necessary that senior managers be able to describe their organizations' high-level enterprise architecture? I would argue "yes". Firms need to have a single picture to guide their efforts, to build a "foundation for execution" as described in Enterprise Architecture as Strategy[ix]. It is a good starting point to have a single picture of the vision, mission and strategies of the firm. However, firms can go one step further to include in this picture organizational wide requirements of business processes that need to be standardized, data that need to be integrated and common IT capabilities that are needed. I do not think there is a "model" high-level enterprise architecture diagram, and at times it can be ambiguous of what to include or exclude from this single picture. I would say constrain the diagram to a single sheet of paper or a single PowerPoint slide, since that will prevent overcomplicating it and makes it easier to communicate. In any case, not having a common picture

will mean that the firm runs the risk of each part of the firm building to their own version of the company's vision.

What does this high-level enterprise architecture look like? An example of high-level enterprise architecture (source: MIT CISR) is included below for reference.

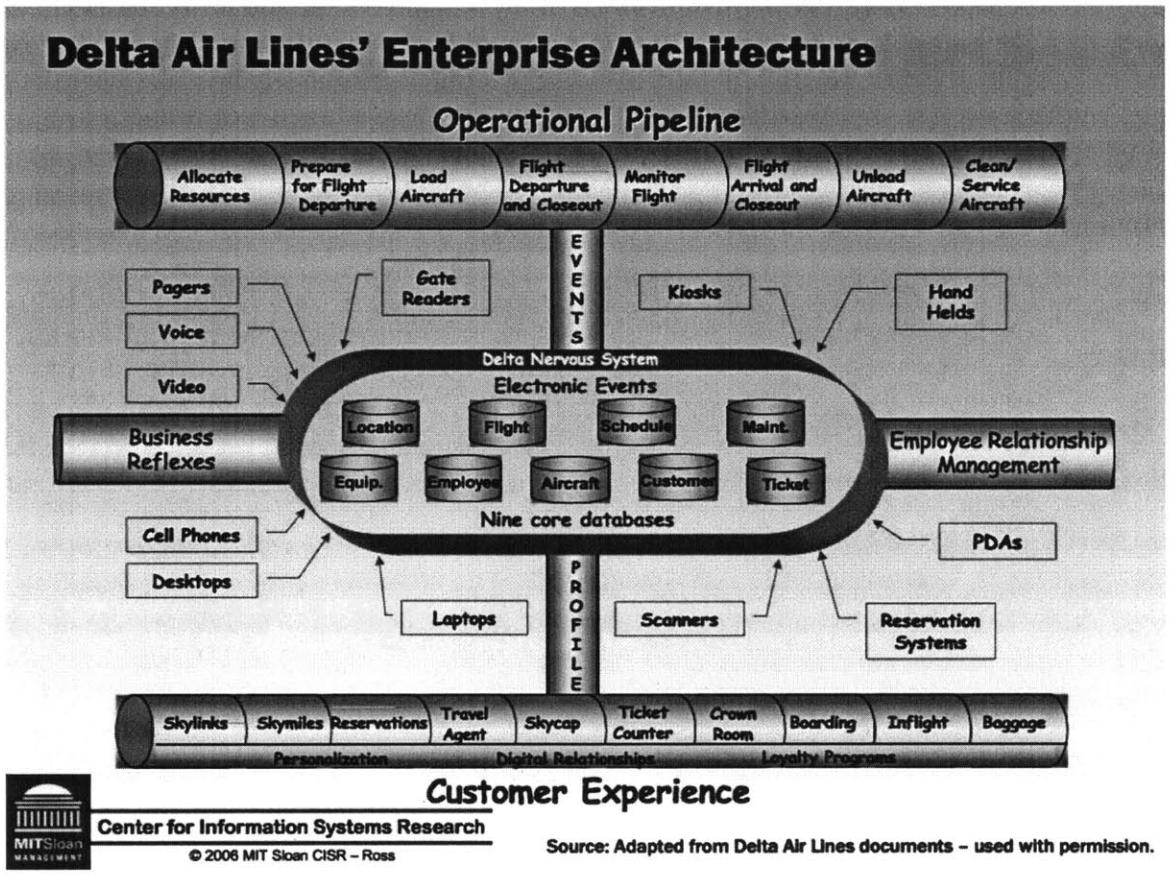


Figure 10 Delta Air Line's Enterprise Architecture

In Delta Air Lines' example, business data is at the center of their enterprise architecture: Location, Flight, Schedule, Maintenance, Equipment, Employee, Aircraft, Customer, Ticket. The top shows the key processes in its operations, while the bottom shows key touch points with the customer. In addition, key technologies like Gate Reader, Laptops, Hand Helds and Scanners are also included in the diagram. This diagram clearly communicates to everyone in the company the business processes that need to be standardized (the operation pipeline processes) and the data that need to be integrated (the nine core databases). With this diagram, senior managers can make some project scope decisions rather quickly and unambiguously:

- Should a planned new application create its own maintenance database instead of using the existing one? Creating its own will be faster and cheaper, and maintenance data is not as important as other data like customer data.

- Should an acquired airline retain its own processes instead of using Delta Air Line's?

It is not that the high-level enterprise architecture need to be treated as commandments cast in stone, and answers to the above questions should always be "no". But it allows senior managers to be reminded what was the agreed design, and then seek necessary approvals when exceptions are needed. Changes can also be made to this high level diagram, but it should not happen too often, as the diagram reflects stakes the company is putting into the ground to establish a platform for its business execution. My observation is that many organizations do not have this single picture, and consequently decision like the ones listed above are made on a case-by-case basis, thus sabotaging the organization's effort to build a coherent platform.

Investigation into Process Savvy and Information Savvy

Following the finding that SG is more process and information savvy than INTL, a key question that comes to mind is: "What enables organizations to be process and information savvy?". Follow-up questions were asked to organizations that rated themselves high in this area to find answers to the above question. See Annex B for the follow-up questions.

What followed was a number of useful information provided by contacted organizations. These information are shared here as best practices, not only to provide answers for the earlier question, but also as reference for other organizations implementing EA on practices they could adopt. The best practices are organized by their originating organization to help readers better appreciate possible interrelations between practices in the same organization.

In addition, a brief case study was also done on one of the organizations to provide an even more detailed understanding on this subject.

Best Practices

The following are some of the best practices in the interviewed organizations:

1. Ministry of Education

Background

"The Ministry Of Education directs the formulation and implementation of education policies. It has control of the development and administration of the Government and Government-aided primary schools, secondary schools, junior colleges, and a centralised institute. It also registers private schools."[xvi]

Best Practices:

a. Created an organizational level Enterprise Architecture scorecard. This is done through an organization-wide, intensive exercise to map out key business areas and Key Performance Indicators (KPIs) for each of the architecture areas. All business units were covered, helping to establish a single and common understanding across the organization of organizational priorities.
b. Have the same internal Business Analyst/Architect (BA) team facilitate the mandatory Business Process Reengineering (BPR) process required of new projects. By becoming the common element in projects, this internal BA team helps to ensure consistency and re-use of processes across projects.
c. Established an information framework that spells out key pieces of information that need to be gathered at the organizational level, e.g. student data and school data.

2. Central Provident Fund Board

Background
The Central Provident Fund Board's mission is to "To enable Singaporeans to have a secure retirement, through lifelong income, healthcare financing and home financing."[xvii]

Best Practices

a. Requires new business initiatives to indicate what they are re-using on a compliance checklist. This facilitates re-use of business processes.
b. Places high-level business flow diagrams in EA repository for sharing across the organization, facilitating business units in understanding other business units' processes, and consequently aiding process standardization and re-use.
c. EA team and BA team, along with other business directors, are included in the review process mandatory to new business initiatives. These teams serve as the common element across business initiatives and thus are well positioned to facilitate standardization and reuse.

3. Ministry of Defence (MINDEF)

Background
"The mission of MINDEF and the Singapore Armed Forces is to enhance Singapore's peace and security through deterrence and diplomacy, and should these fail, to secure a swift and decisive victory over the aggressor."[xviii]

Best Practices

a. Tied funding and permission to system go-live to EA artifact creation/update. New projects will need to add the required documentation (or update existing documentation) to the EA repository before they can receive funding. This helps ensure that information in the EA repository is kept updated, and makes it easier to spot missed opportunities for standardization and re-use. As some EA artifacts will only be produced during the development phase, the EA team will check and ensure that all necessary EA artifacts are created before issuing a certificate of EA compliance to the project team. Without this EA certification, the developed system will not be allowed to go-live (i.e. deployed).
b. EA artifacts used to solve operational problems, e.g. identifying bottlenecks in process. This is happening bottom-up rather than top-down, but it is a good indication of the accuracy and usefulness of the data in the EA repository.
c. Optimizes business processes through the use of simulation. Once business processes with bottlenecks have been identified, solutions are proposed and then translated into simulations to verify their effectiveness. Only then are these changes implemented.
d. Moving towards model to execution, such that high level models created in the EA repository can be translated into business rules used by everyday

operations. Sees that this technology will help reduce paper documentation and errors in translating models to operational business rules.

Case Study: Housing and Development Board

To provide more details on process savvy and information savvy organizations, a brief case study was done on one of the organizations that scored high for these characteristics. The organization is the Housing and Development Board. They have graciously allowed me to share about their organization, specifically on key enablers facilitating their business process design.

Background

Housing and Development Board (HDB) is a Singapore government organization established with the mission of providing quality and affordable housing for Singapore citizens. Public housing plays a very important role in Singapore, as more than 8 in 10 Singaporeans live in public housing[xix]. HDB has more than 5,000 employees working round the clock to achieve its mission, tending to the housing needs of the 4 million residents in Singapore.

Clear and Common Understanding of Key Business Processes

HDB has a clear understanding of their key business processes. The processes are divided into 13 business areas and 3 functional areas, as depicted in Figure 11. The 13 business areas—for example Research & Town Planning, Property Planning and Administration, Building Design—each has its own processes as listed in the respective boxes. The 3 functional areas—Building & Estate Services, Corporate Finance and Accounting, Corporate Support Services—provide services that are shared across the organization.

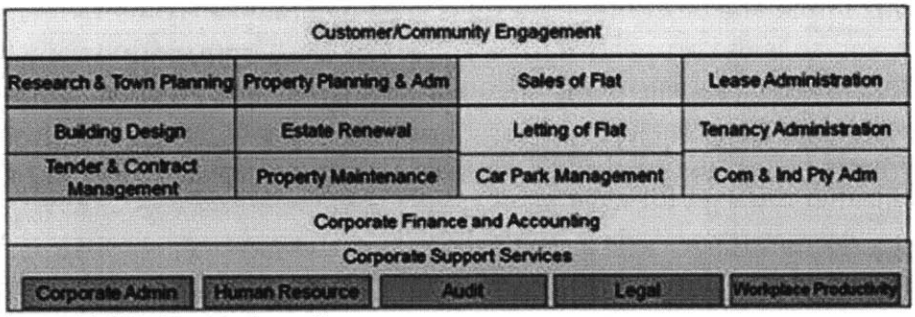


Figure 11 HDB Key Business Processes

In addition to having a clear understanding of the key processes, this understanding is shared among HDB's senior managers, providing them with a common platform to discuss business processes and how processes could be improved. In comparison, less mature organizations do not have such a consolidated listing, or the listing only exists in the heads of senior managers.

Strong Governance Process to Ensure Alignment

HDB has a strong governance process in place to ensure that processes are standardized, re-used and optimized. The Enterprise Architecture team works very closely with business users and is involved in key stages of projects.

Firstly, each business area is supported by a group of domain enterprise architects (which include business architects, information architects, and application architects) to facilitate alignment between each business area and the organization's blueprint (i.e. enterprise architecture). This alignment is further ensured as each project is assigned a domain enterprise architect. Any deviation from the enterprise architecture will require support from the domain enterprise architect, before the project can seek necessary approvals.

In addition, during the planning stage of projects, project proposals are validated for compliance against the enterprise architecture. This validation is done through discussions of project proposals at the Enterprise Architecture community, which is attended by all domain enterprise architects. Projects not in accordance to the Enterprise Architecture will be follow-up by domain architects, who will explain to projects owners on the architectural requirements.

Furthermore, project requirement studies need approval from the EA review board chair (the group director for information systems). The EA review board chair's support is also needed to initiate IT projects.

Clear Understanding of Key Datasets Needed by Key Processes

HDB identified 12 key data sets, depicted in Figure 12. These data sets are owned by business owners. HDB has a clear understanding of how these data sets support key processes. For example, the customer data set is used by many of HDB's business processes, and so is the property data set. They have an information architecture principle that "All data are shared", and a culture of sharing data.

In comparison, some organizations have separate data sets for each business process, e.g. one customer data set for each business process.

1. Property	5. Season Parking	9. Financial
2. Car Park	6. Enforcement	10. Contract
3. Sales	7. Property Maintenance	11. Contractor
4. Rental	8. Upgrading	12. Customer

Figure 12 HDB's Key Data Sets

Conclusion on Process Savvy and Information Savvy Organizations

The best practices and case study provided insight into practices that might help organizations become process savvy and information savvy. The theme of strong governance processes was clearly visible in these organizations, reinforcing an earlier point on the importance of governance on architectural maturity.

Other Discussions - Where the Chief EA sits makes no difference?

Many thoughts and observations arose as I did the literature review, interviews with CIOs and analysis of survey data. This section shares one particular theme that arose from the interviews with CIOs.

Enterprise Architecture deals with the blueprint of enterprises, so it might make sense that the blueprint function sits close to the Chief Executive Officer in the organization chart to ensure alignment between plan and execution. Is there a correlation between where the Chief Enterprise Architect sits in the organization chart and the EA maturity of that enterprise?

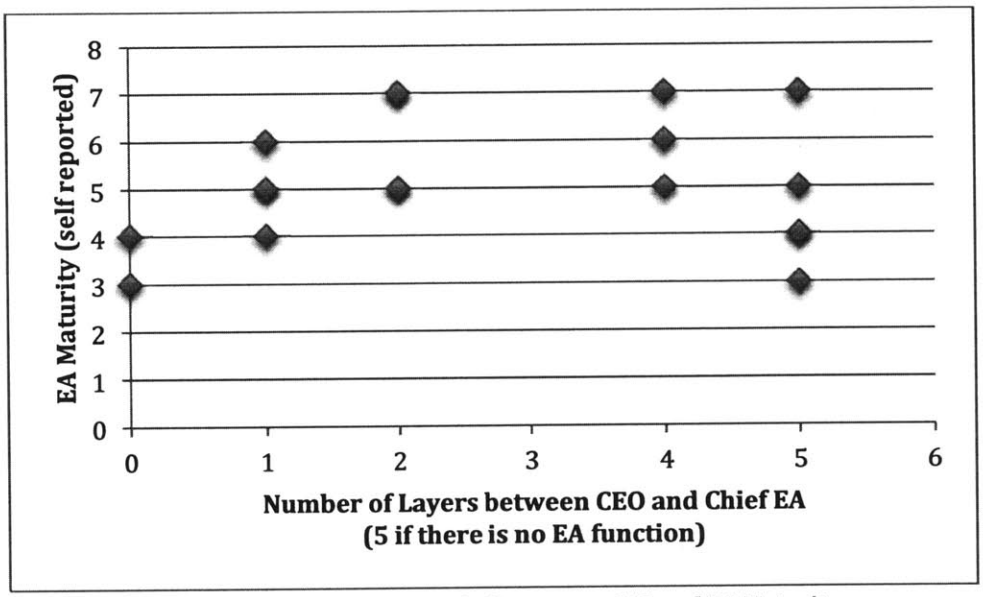


Figure 13 Relationship between Chief EA's distance to CEO and EA Maturity

Figure 13 shows the data from this survey. No clear pattern can be identified. Some might even argue that having two to four layers between the CEO and the Chief EA is the best!

In fact, research done by Massachusetts Institute of Technology's Center for Information System Research suggests the same result: that there has been no support in data of correlation between an organization's chief EA's proximity to the CEO and its EA maturity.

Does this mean that it does not matter where the chief EA sits in organizations? In many organizations, the CIO is the chief EA, so does that also mean that it does not matter where the CIO sits in organizations?

Through the interviews, I noticed that the organizations who reported having mature EA roughly falls into three groups. The first group is made up of organizations with very influential CIOs who reported either directly into the CEO or to a direct report of the CEO. The second group has stories of their CEO believing

strongly in EA, and pushed the EA agenda top-down. The third group consists of organizations that I was not clear why they reported high maturity for their EA. It might be a lack of understanding on my part, but I also suspect some of them are still early in their EA journey and thus not yet equipped to provide an accurate assessment of their EA maturity.

Analyzing the mature organizations give the following thought: where the chief EA sits is less important to an organization's EA maturity than EA's mindshare among senior managers. If the CEO believes in EA, the organization is more likely to have mature EA. If the CIO is influential and believes in EA, it is more likely that he can influence the CEO to think the same. The challenge though is that it is difficult to measure EA's mindshare among senior managers, but this does reinforce an often-repeated EA best practice on the importance of gaining top management's sponsorship to achieve successful EA implementation.

How Singapore Government can better leverage EA

In this section, we will present our hypothesis based on the research findings of how Singapore Government can better leverage EA

In this research, we have found that Singapore Government agencies have more successful IT projects and more mature EA, and we attributed that to its strong governance processes.

However, we believe that we strong governance only provides half of the key to strong EA. The other half requires organizations to have a common view within the organization of strategic capabilities it wants to build in the long term. These strategic capabilities come in the form of standardized processes, shared data entities and common IT capabilities. *Enterprise Architecture as Strategy* calls this common view the "foundation for execution".

To build this foundation, organizations need architecting/design expertise that has deep understanding of the organization's process, data and IT capabilities. Furthermore, this expertise needs to be with the organization for the long-term to ensure proper adherence to the desired foundation. For these reasons, in-house personnel who can straddle between business and technical issues might be best suited for this task.

For SG, outsourcing within organizations might have drained it of architecting/design expertise. Organizational incentives and attitudes favoring managerial skills over technical skills might also have further worsened the situation. As such, SG might consider the need to rebuild architecting/design expertise, possibly through hiring, changing organizational attitudes and incentives and relooking at outsourcing strategy to stem the outflow of such expertise.

Assumptions of Hypothesis

One key assumption of the hypothesis is in terms of causality. The hypothesis assumed the causality model depicted in Figure 14.

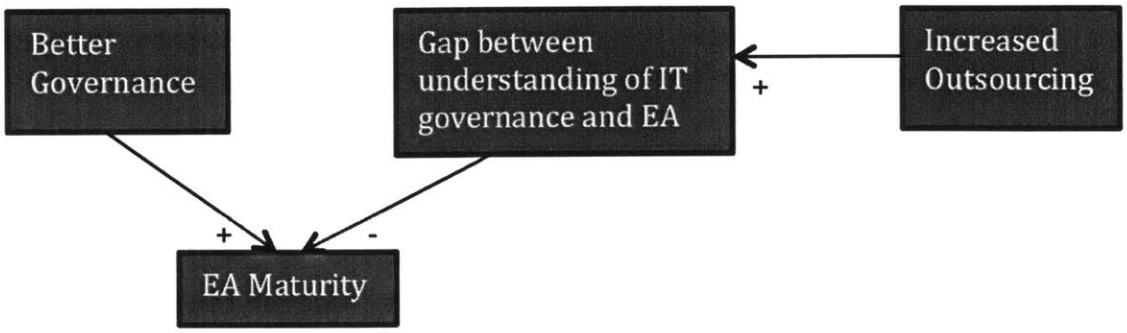


Figure 14 Assumed Causality Model

This model assumes that SG's more mature EA is a result of its better governance, and that its EA could even be better if the gap between understanding of IT governance and EA among its senior managers was smaller. Moreover, the model also made the assumption that increased outsourcing will increase the IT governance vs. EA gap.

The assumptions of causality are made based on reasoning and anecdotal evidence, and not on statistical evidence from the survey data. Other causality models are possible, and should be considered when reviewing the hypothesis. One alternate causality model that is plausible is that increased outsourcing results in more mature EA, as SG is able to focus on the truly important issues.

Conclusion

Enterprise Architecture can help organizations have greater clarity over their plans and build foundations for execution that put them ahead of their competitors. Through this research, we saw that Singapore Government agencies (SG) showed results consistent with earlier research, that greater EA maturity resulted in better business outcomes.

We found that on average, SG has more mature EA than organizations in the international survey (INTL), which can be explained by SG's strong governance processes, and possibly its good outsourcing practices. In addition, SG provides a good example of how strong governance processes lays a strong foundation for mature EA.

We also examined the relationship between EA and outsourcing, and saw that these two elements can mutually benefit each other. Good outsourcing frees up management time to focus on EA, while EA guides outsourcing on what should or should not be outsourced. At the same time, outsourcing can hurt EA by draining the organization of needed architecting/design expertise for successful EA.

Lastly, we investigated why significantly more senior managers know IT governance compared to high-level EA. We argued that organizations need to have a single picture of their high-level enterprise architecture, to guide their efforts in building a "foundation for execution", or else they risk building capabilities that when considered together do not represent any coherent strategy.

Based on these findings, and taking into consideration the model where successful IT requires two key pillars—IT governance and enterprise architecture[3], we hypothesized that Singapore Government Agencies can strengthen its EA by building a stronger in-house architecting/design capability. We postulated that this might be achieved by revisiting outsourcing strategy to stem the outflow of technical skills from the organization. In addition, SG can also consider changing organizational attitudes and career prospects towards those skills to encourage their development.

[3] Based on the IT engagement model in "*Enterprise Architecture as Strategy*"

Areas needing Further Research

A number of interesting research questions arose through the course of this research. These can be useful topics for future research. They are captured here for the reference of future researchers.

1. Comparing SG against INTL organizations that have mature EA. Singapore Government strives to be a world-class organization. As such, it should not compare itself against the average, but instead should compare itself against the best in the world. Doing such a comparison will yield insights into how SG fare against the best in the world, and what are possible areas of improvement SG can focus on.
2. Comparing IDA managed sites against non IDA managed sites. The IT in about half of the 80+ Singapore Government Agencies is managed by Infocomm Development Authority of Singapore (IDA). What are the differences between EA maturity in IDA-managed agencies versus that in non IDA-managed agencies?

Annex A: Statistically significant differences between SG and INTL survey responses

Enterprise Information
- Number of autonomous business units

Enterprise IT
- % Run budget outsourced
- % Build budget outsourced
- % IT asset in Centralized data
- % IT asset in Technology infrastructure
- % Senior managers that can describe IT governance

Enterprise Architecture Management
- % Senior managers that can describe high-level enterprise architecture
- How often are enterprise architects involved in SAAS/PAAS decisions?

Project Management Practices – All 7 items

Funding Practices – All 7 items

Business Process Design Practices – 6 out of 8 items
- Explicitly defined a small set of high level processes
- Has high-level process owners
- Has a culture of business process reuse
- Identified non-IT data owners
- Creates/revises business rules based on business analytics
- Operational decision makers have access to the information for business rules

Innovation Management
- Routinely designs and analyzes strategic experiments to test innovative ideas

Outcomes
- % IT projects that achieved intended business objective

Focus of Enterprise Architecture
- EA maturity stage
- Senior business executives agree on enterprise operating model

Annex B: Follow-up Questions on Process and Information Savvy

With the objective of understanding better the practices of process and information savvy organizations, the following questions were sent to SG organizations with high scores in practices related to process savvy and information savvy.

1. High-level Business Processes
    a. What are the organization's key business processes? Who are their owners and what are the interrelationships between these processes?
    b. What is the level of agreement among senior managers over the definition of the organization's key business processes (1-mostly disagree; 5-mostly agree)?
    c. What are the carrots and sticks to standardizing, adopting and optimizing processes?
    d. What is the standard process optimization approach?

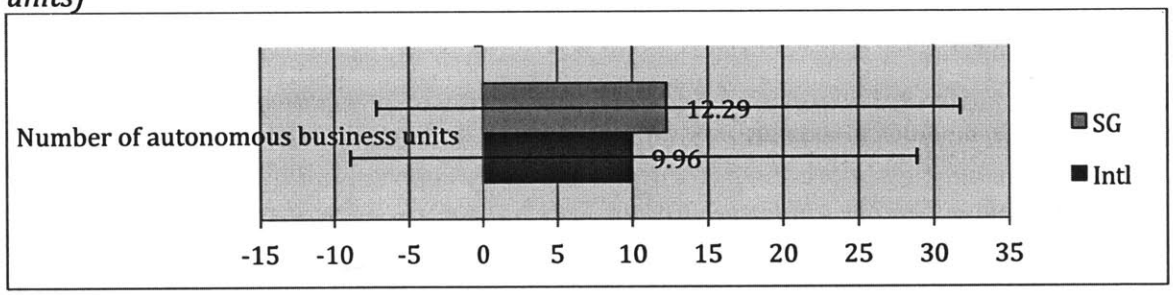
2. High-level Business Data
    a. What are the organization's key data sets and their owners?
    b. What are the relationships of these data to high-level business processes?
    c. What are the tools/barriers to accessing these datasets?

Annex C: Survey Questions and Results

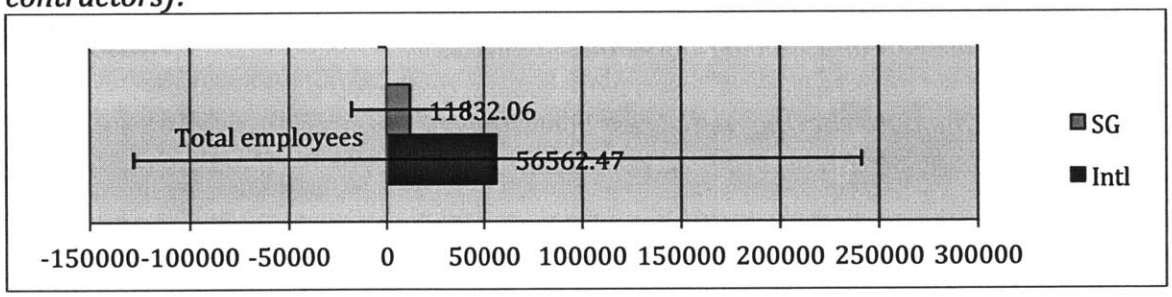
This annex lists the results for some survey questions presented to the surveyed organizations. Only questions with numerical results are included, as this section's intent is to provide information on the mean values and standard deviation for the responses to those questions.

Enterprise Information

Question: How many autonomous business units with profit and loss responsibility report into the top level of your enterprise? (Note: if the enterprise is a single line of business, please enter "1"; it is fine to ignore very small and experimental business units)

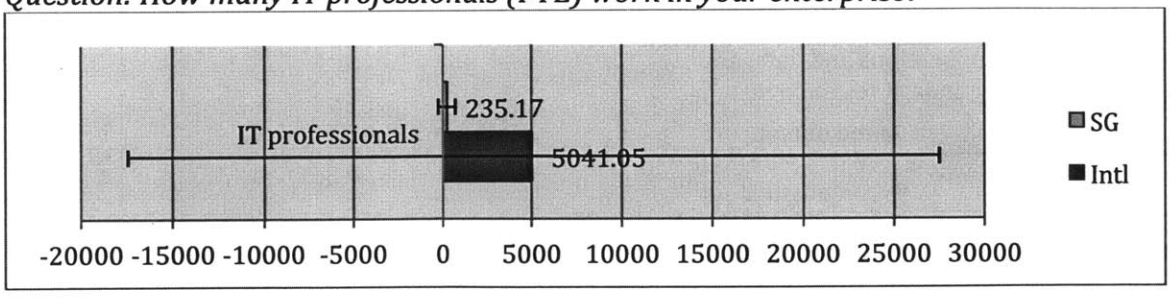


Question: How many total employees work in your enterprise (including long-term contractors)?



Enterprise IT

Question: How many IT professionals (FTE) work in your enterprise?



The next chart shows results to the following questions (Note: read chart from bottom to top)

What is your enterprise's total IT spending as a percentage of revenues? Include both operating and capital spending (excluding depreciation), i.e., hardware, software,

outsourcing, contracting, communications, phone, and people dedicated to providing IT services in your total IT spending. (Non-Profits, Educational organizations, and Government please report IT spending as a % of total budget)

Of your total enterprise-wide IT spending, what percentage is allocated to:

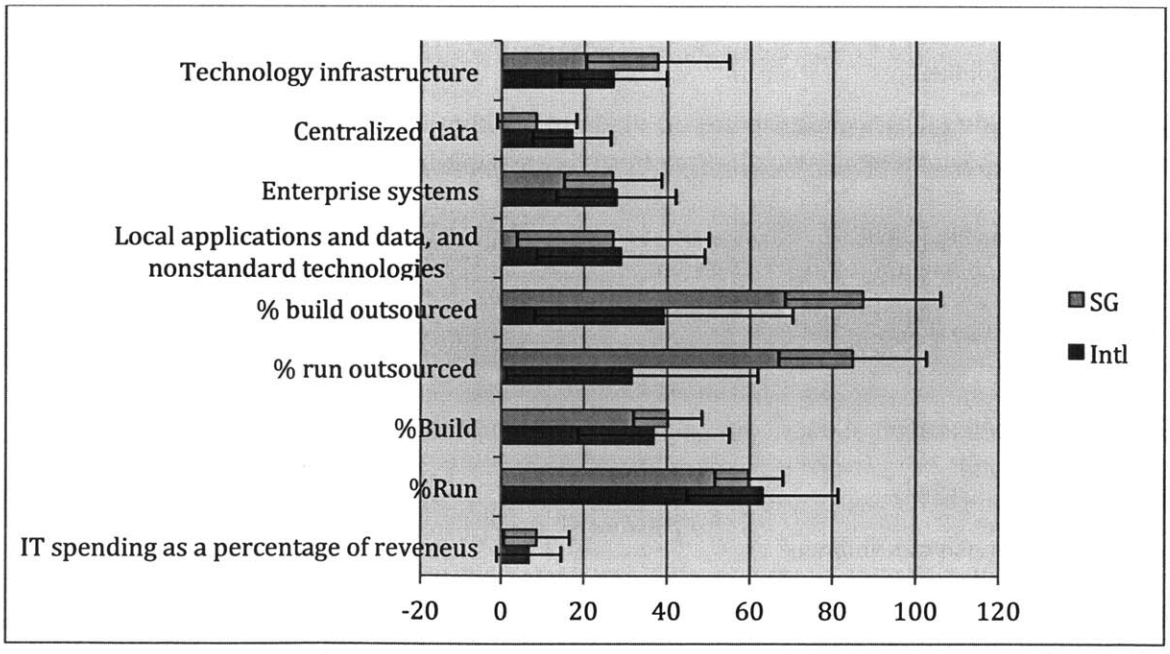
- *Running existing systems (including maintenance and minor modifications)*
- *Building and implementing new systems*

What percentage of your enterprise's RUN budget is currently outsourced/contracted?

What percentage of your enterprise's BUILD budget is currently outsourced/contracted?

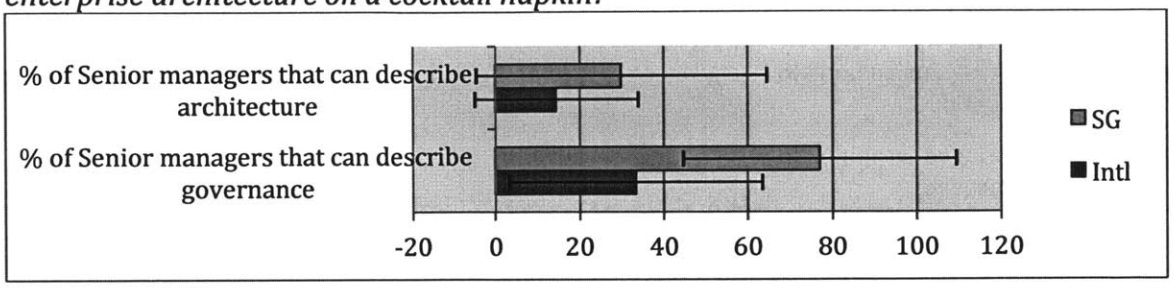
Consider the IT assets (acquisition and development costs for hardware, software, data) in use in your enterprise today. Of your enterprise's cumulative investment in IT assets in use today, estimate the percentage currently represented by each of the 4 categories below. (Please allocate 100% of your hardware, software and data to these four categories. We realize this is a rough estimate.)

- *Local applications and data, and nonstandard technologies (e.g., applications unique to individual business units or local functions, including unique data and technology supporting those applications)*
- *Enterprise systems (e.g., shared and standard applications used across organizational units, including standard portals)*
- *Centralized data (e.g., databases, warehouses, and related technologies facilitating data sharing and access across business units)*
- *Technology infrastructure (e.g., core technology standardized across the enterprise)*



Approximately what percentage of your senior business managers can accurately describe your enterprise's IT governance?

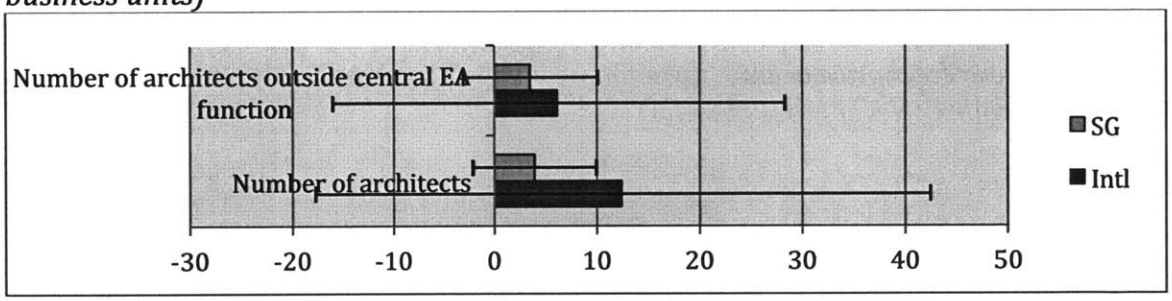
What percentage of your senior business managers can draw a high-level view of the enterprise architecture on a cocktail napkin?



Enterprise Architecture Management

How many enterprise architects are assigned full-time to your central EA team/function? (do not include solutions architects)

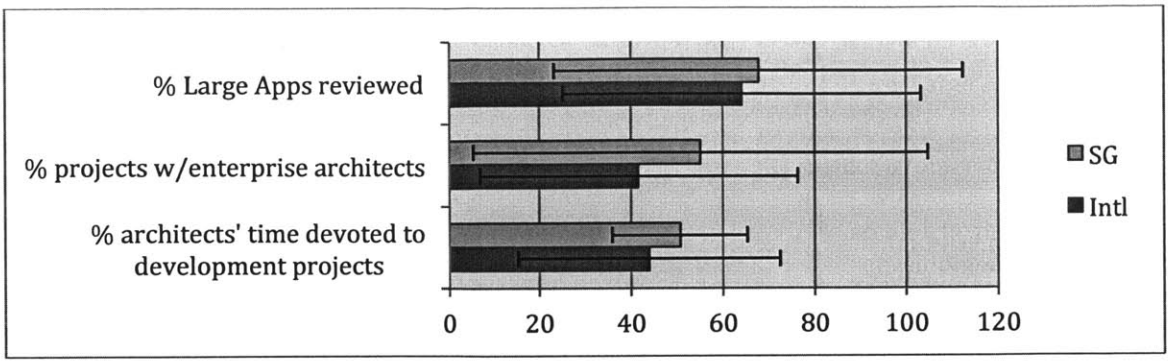
How many enterprise architects report outside the central EA team/function? (e.g., in business units)



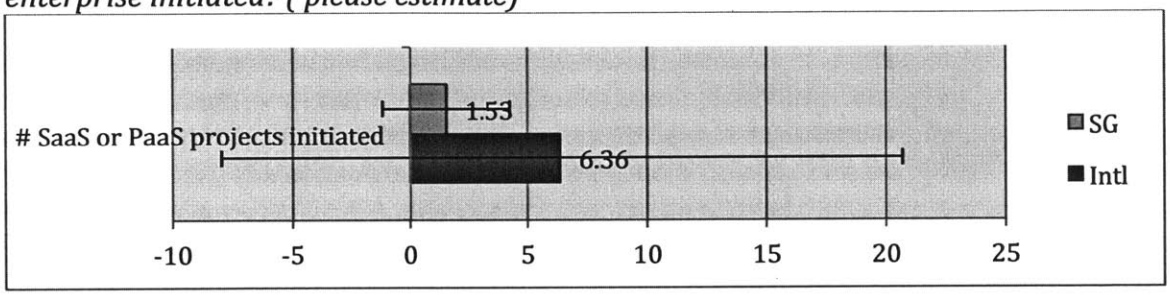
What percentage of the above enterprise architects' time is allocated to development projects?

What percentage of application projects/change initiatives have an enterprise architect?

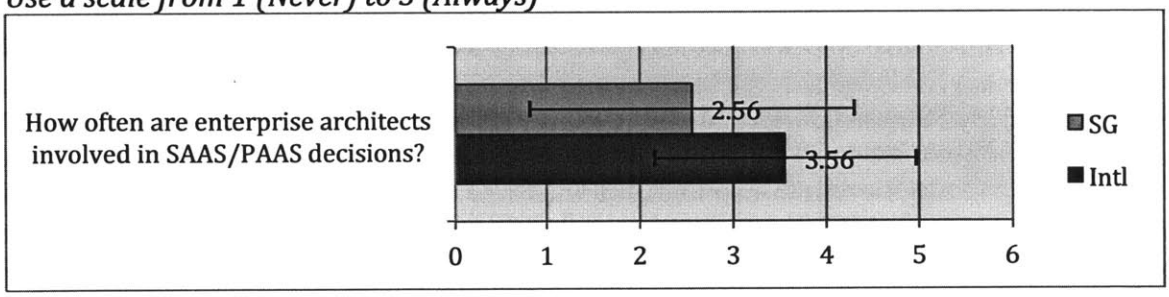
What percentage of large application projects are reviewed for enterprise architectural compliance early in the development life cycle?



In the last 3 years, how many SaaS or Platform as a Service projects has your enterprise initiated? (please estimate)

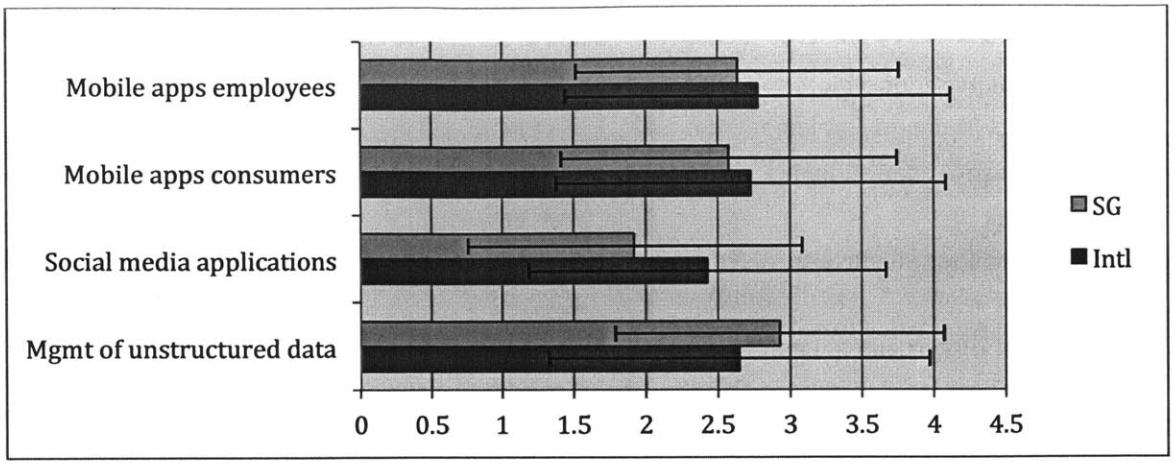


How often were enterprise architecture teams involved in these SaaS/PaaS decisions? Use a scale from 1 (Never) to 5 (Always)



To what extent are the following capabilities integrated into your enterprise architecture:
Use a scale from 1 (Not at all) to 5 (To a great extent), NA=Not applicable

- Management of unstructured data
- Social media applications
- Mobile device applications for consumers
- Mobile device applications for employees

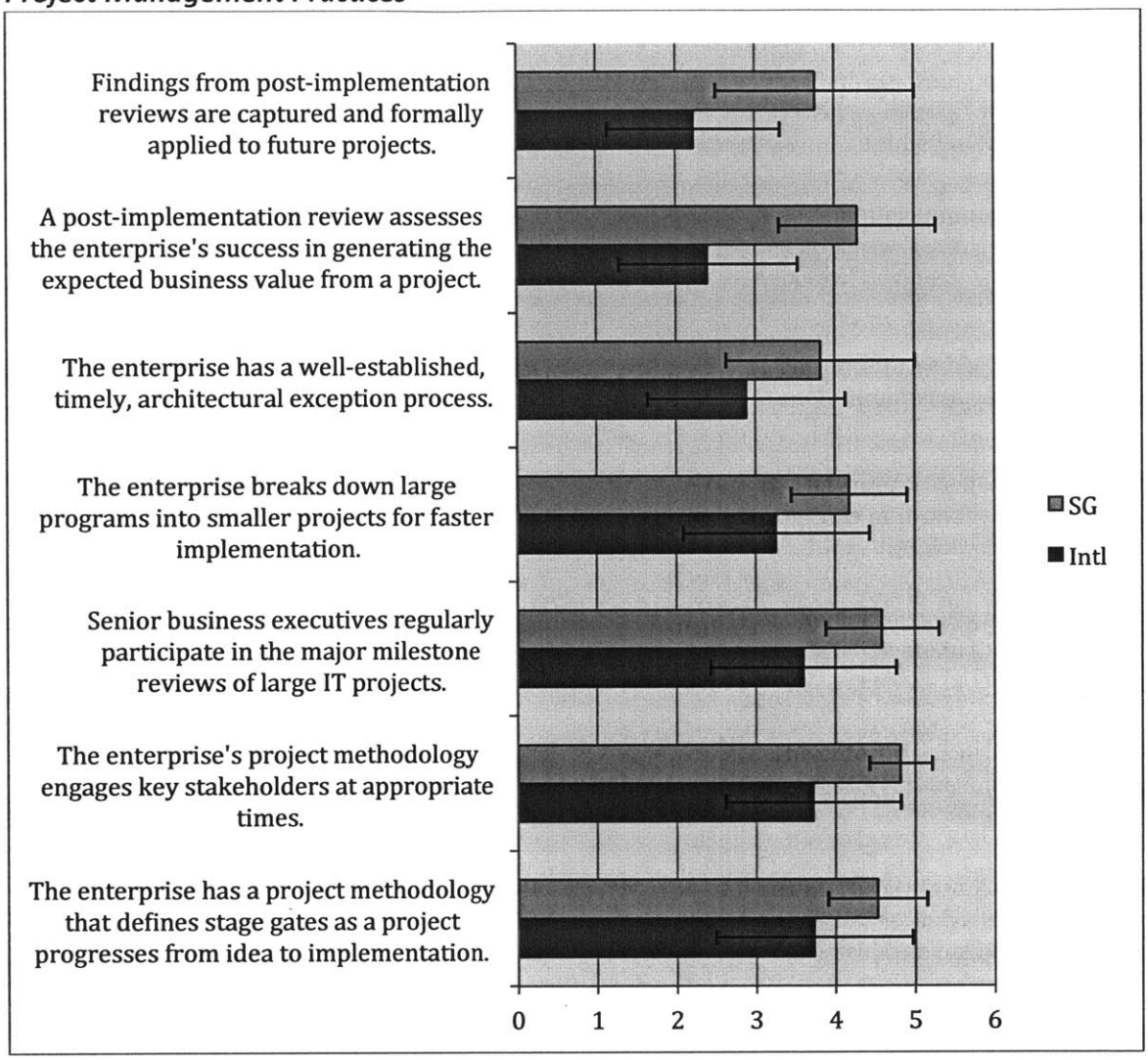


Enterprise Architecture Management Practices

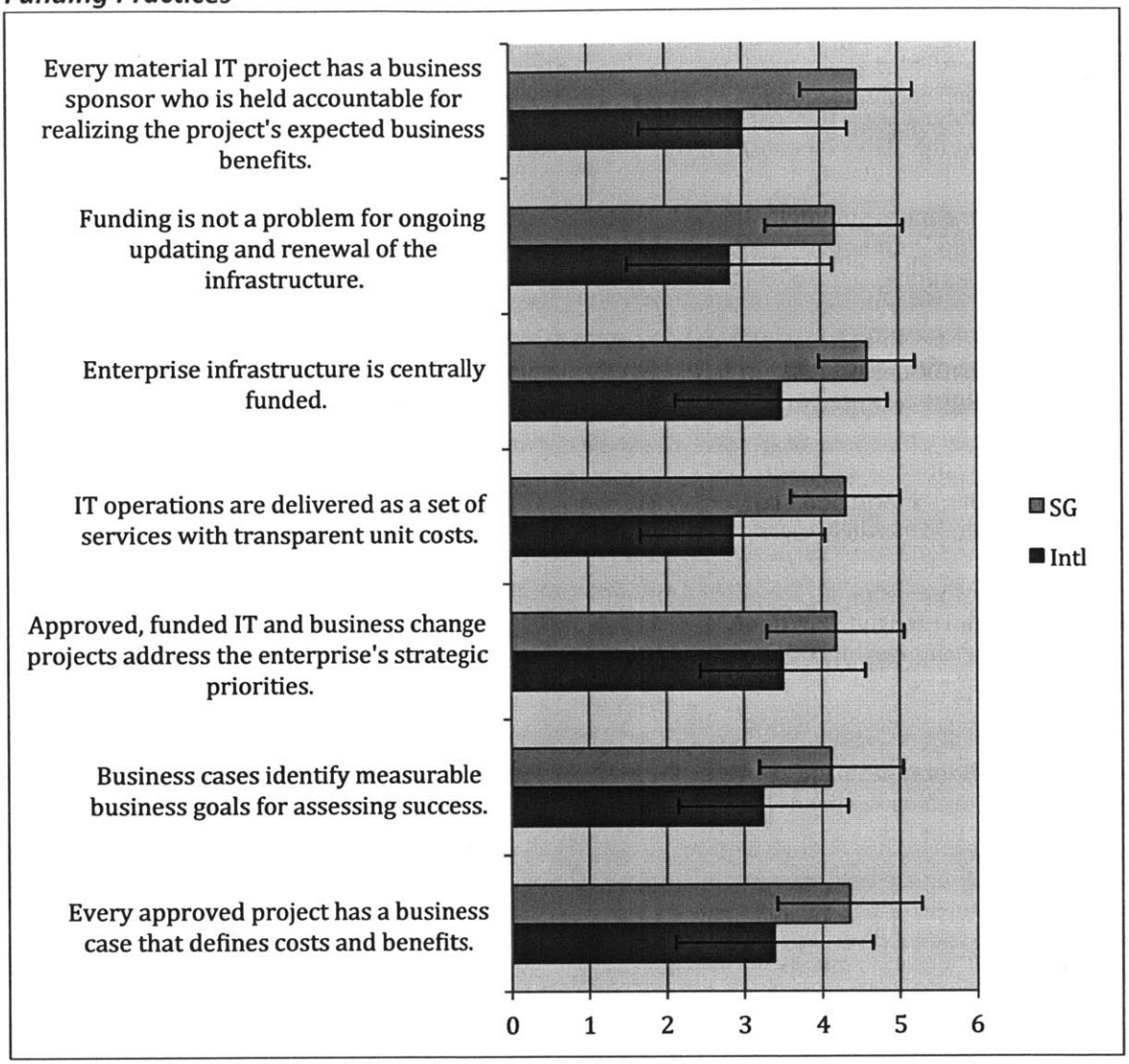
To what extent do the following statements describe management practices for your enterprise?

Use a scale from 1 (Strongly disagree) to 5 (Strongly agree), NA=Not applicable/Do not know

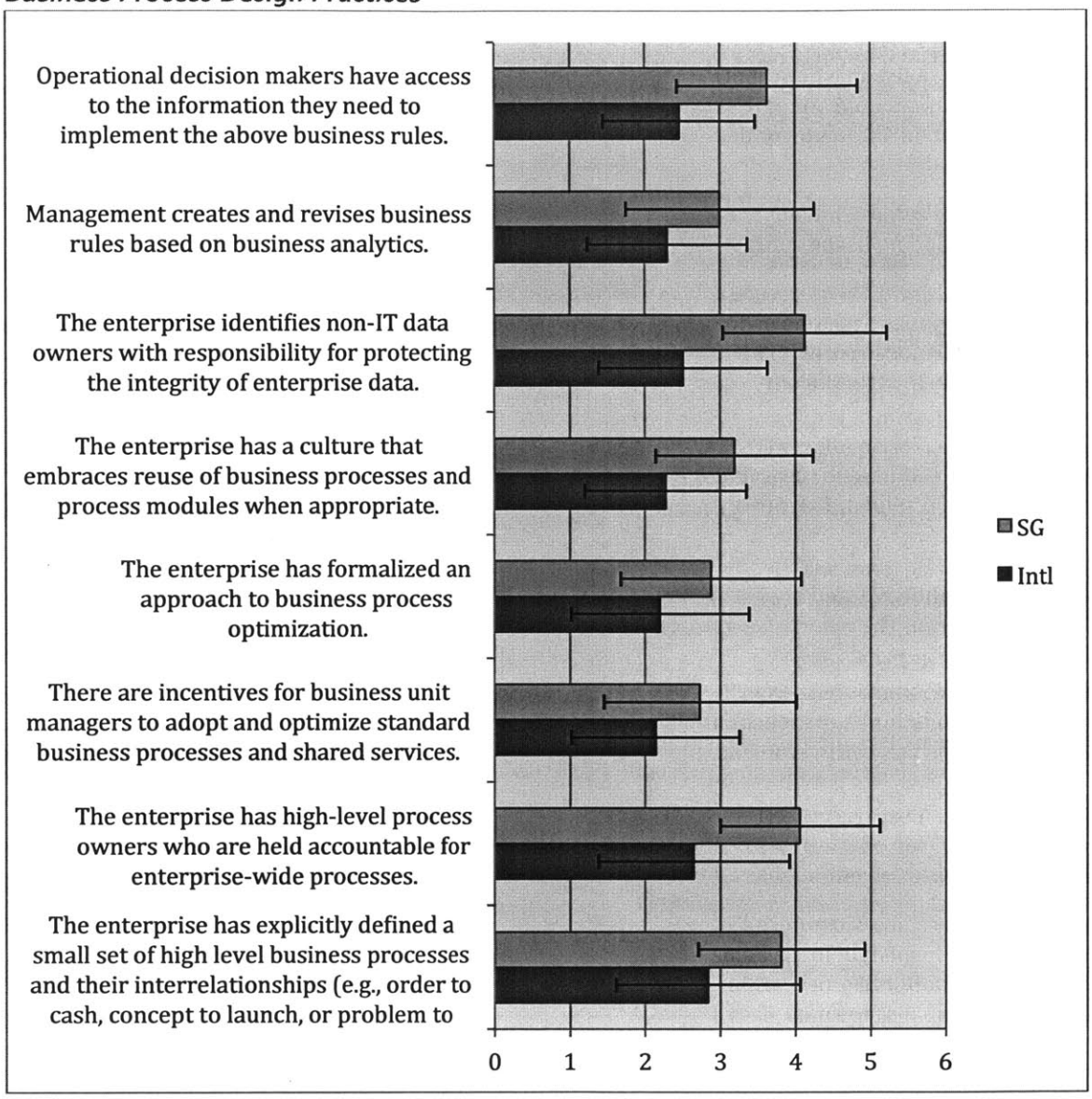
Project Management Practices



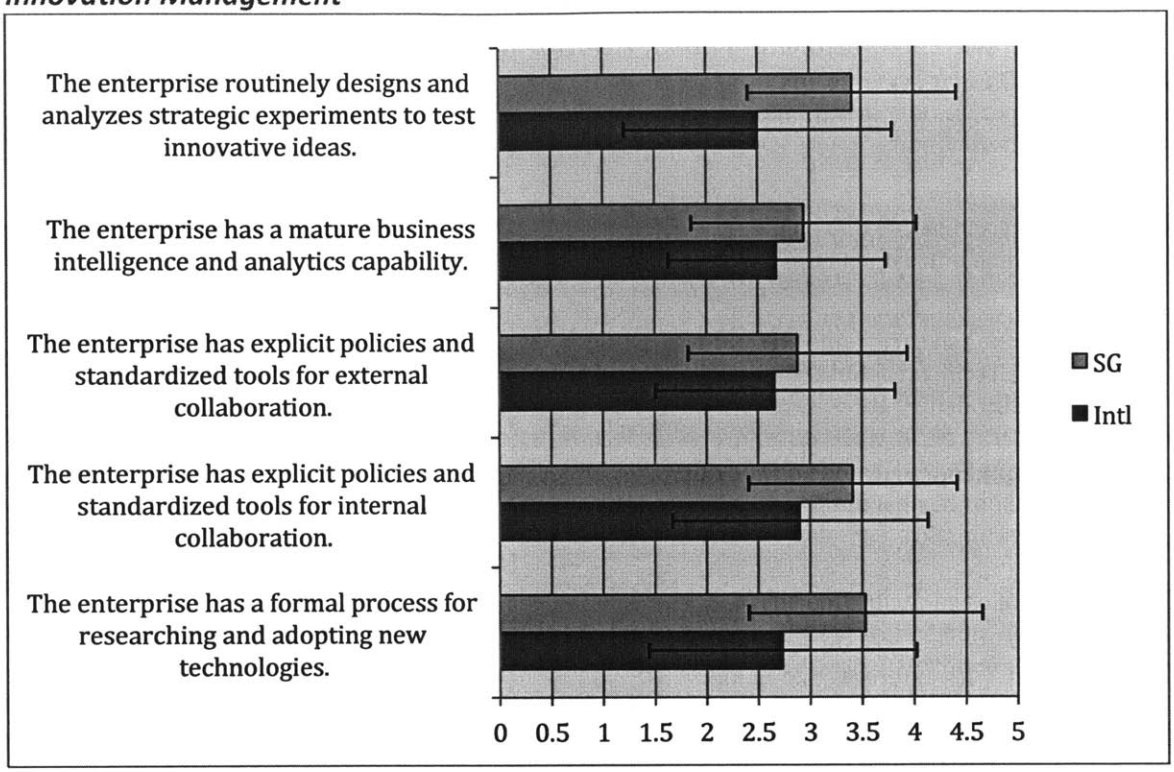
Funding Practices



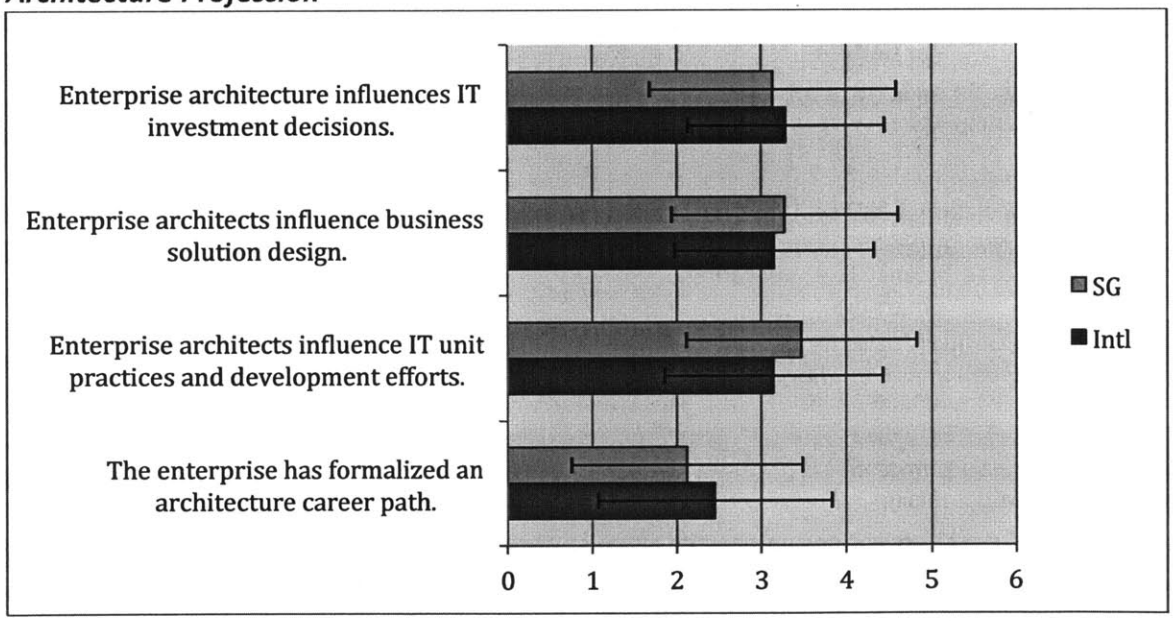
Business Process Design Practices



Innovation Management



Architecture Profession

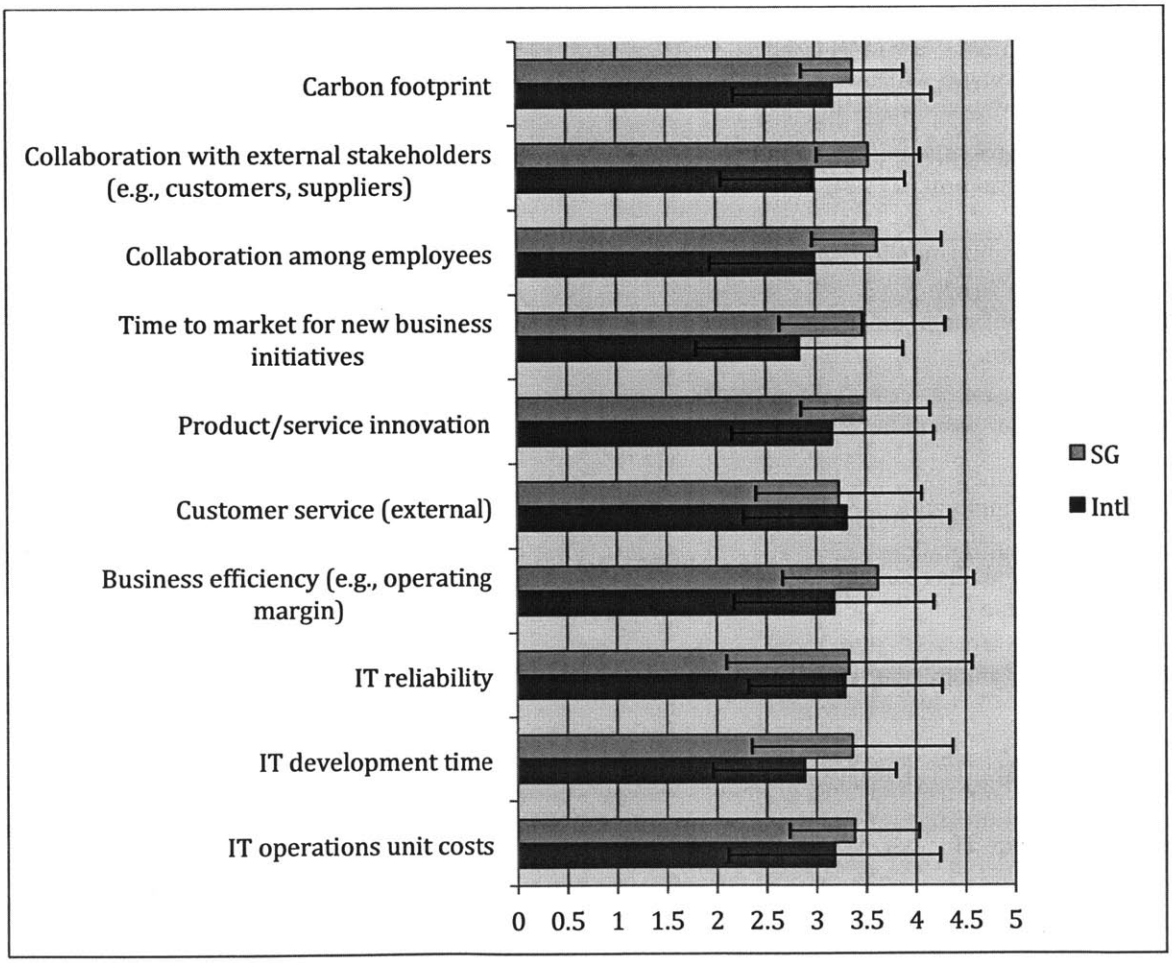


Enterprise Architecture Outcomes

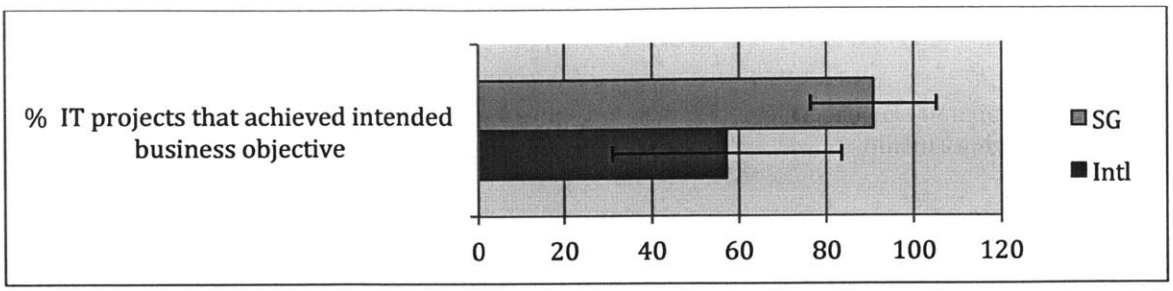
How does your enterprise compare to competitors in each of the following areas? Estimates are fine.

Use a scale from 1(Lower performing than competitors) to 5 (Higher performing than competitors) with 3 = Performing about average for your industry; NA=Not applicable/Do not know

- *IT operations unit costs*
- *IT development time*
- *IT reliability*
- *Business efficiency (e.g., operating margin)*
- *Customer service (external)*
- *Product/service innovation*
- *Time to market for new business initiatives*
- *Collaboration among employees*
- *Collaboration with external stakeholders (e.g., customers, suppliers)*
- *Carbon footprint*



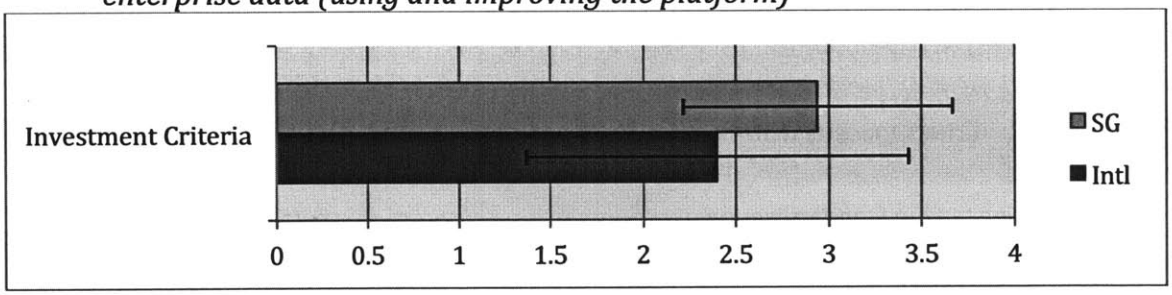
What percentage of IT projects in the last year achieved their intended business objectives? Please leave blank if you do not know.



Focus of Enterprise Architecture

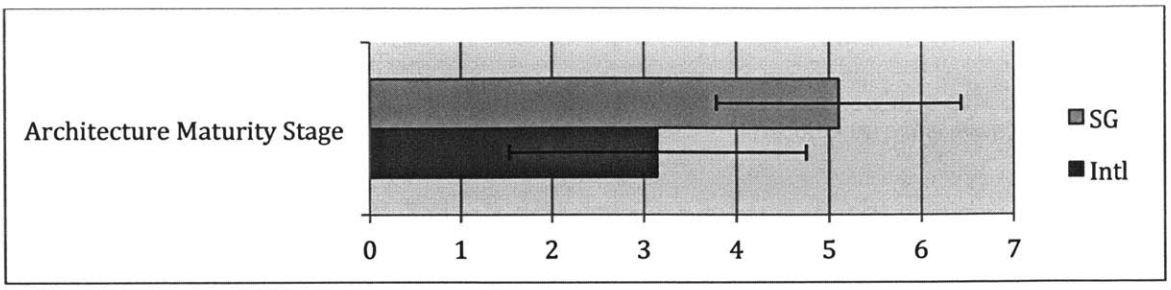
Which of the following best captures your current enterprise IT investment priorities? (please choose one)

1. *Addressing local business unit or functional needs*
2. *Building a standard and shared technology infrastructure while meeting local business priorities*
3. *Standardizing business processes and/or data across the enterprise (building a platform)*
4. *Reusing and leveraging a platform of shared business processes and/or enterprise data (using and improving the platform)*



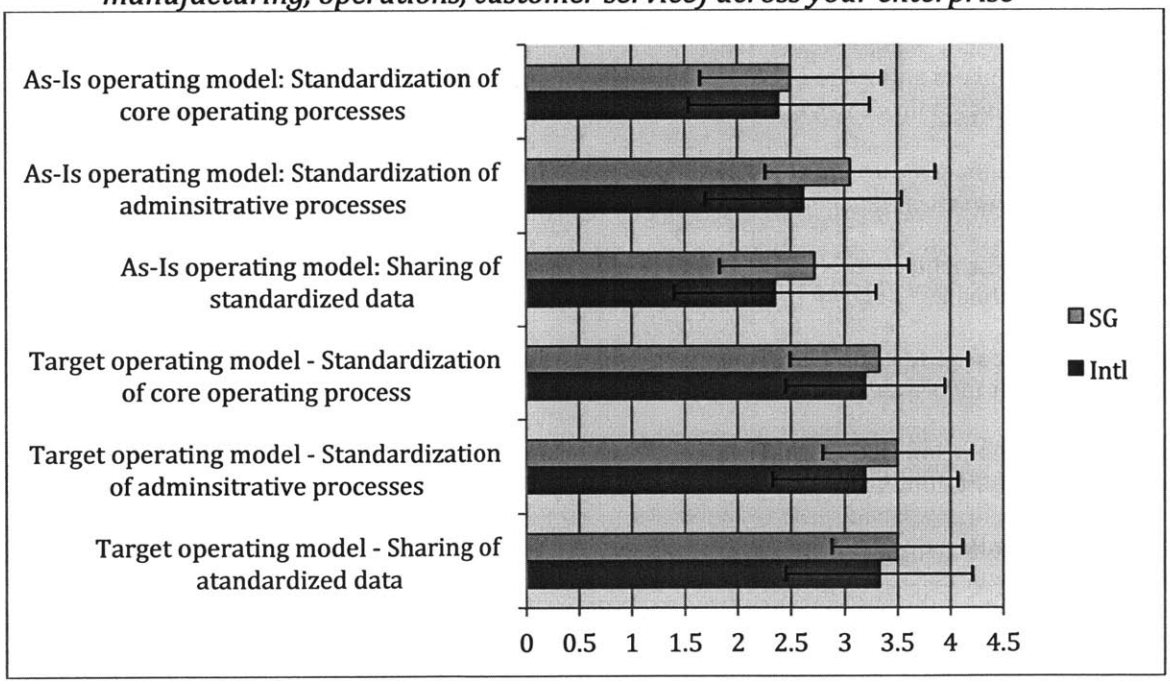
In prior research we identified 4 stages of architecture maturity. If you are familiar with this research, please indicate which of the following best captures the enterprise architecture of your enterprise:

0. *Not familiar with prior research*
1. *Stage 1: Business Silos*
2. *Between Stage 1 and Stage 2*
3. *Stage 2: Standardized Technology*
4. *Between Stage 2 and Stage 3*
5. *Stage 3: Business Optimization*
6. *Between Stage 3 and Stage 4*
7. *Stage 4: Business Modularity*

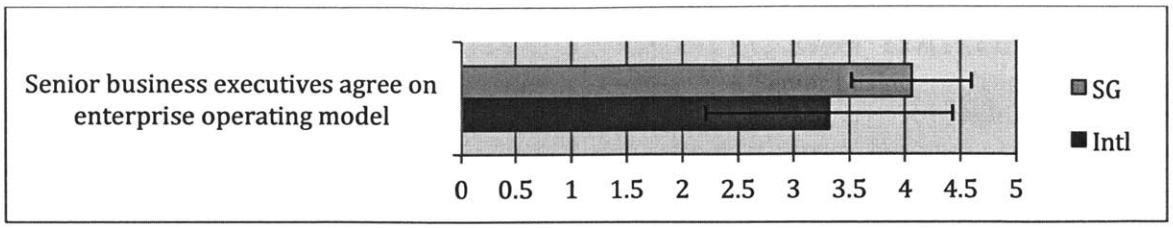


Targeted Operating Model: *For your enterprise to operate the way customers expect it to operate, indicate your enterprise's need for each of the following integration and standardization requirements. Use a scale from 1 (Low need) to 4 (High need)*
As-Is Operating Model: *Indicate your enterprise's existing (as-is) IT-enabled capabilities. Use a scale from 1 (Low level of standardization) to 4 (High level of standardization)*

- *Sharing of standardized data (e.g., product, customer, partner) across your enterprise (refers to individuals' need to access data generated in other parts of the business in order to do their jobs, not the need to aggregate for performance results)*
- *Standardization of administrative processes (e.g., HR, finance, purchasing) across your enterprise*
- *Standardization of core operational processes (e.g., supply chain, manufacturing, operations, customer service) across your enterprise*

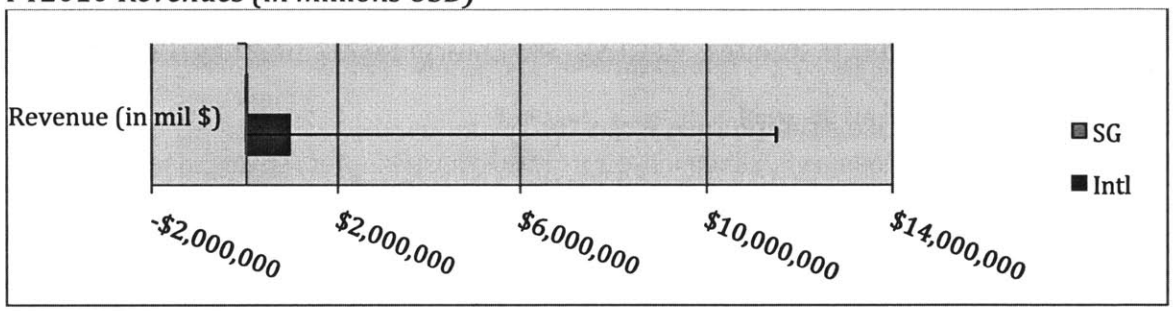


Senior business executives agree on, and have articulated, the above enterprise operating model. Use a scale from 1 (Strongly Disagree) to 5 (Strongly Agree)



Financial Performance

FY2010 Revenues (in millions USD)



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