The adoption of software process improvement programs (SPI) in Canada and the English-speaking Caribbean: A comparative analysis

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MSBM Inaugural Conference on Business and Management, Montego Bay, Jamaica, January 9, 2015

Agenda

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Research Problem

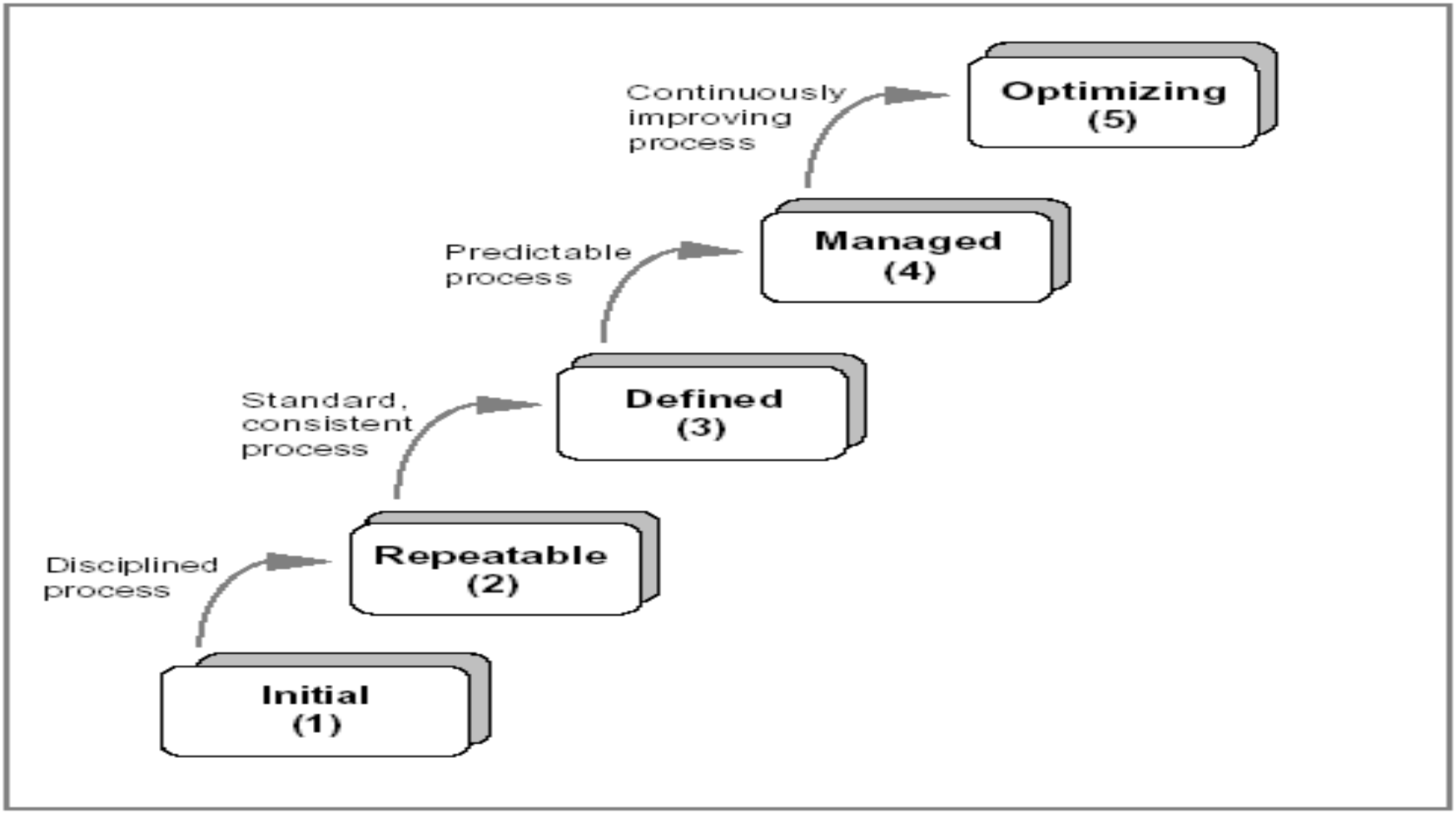
- The information systems (IS) community is plagued with the delivery of low quality software products (Standish Group, 2013)
- This condition is more adverse in developing countries (Niazi et al., 2010) because they suffer from severe resource constraints (Kimaro, 2006)
- Both developed and developing countries have been searching for initiatives to overcome the problem
- Software process improvement (SPI) can assist firms to produce high quality software and give a competitive advantage (Srinivasan & Murthy, 2010)
- Research in developed countries revealed benefits such as reduced project cycle time, reduced development cost and improved software quality (Clarke & O'Connor, 2013)
- But the rate of adoption is low because these programs are seen as costly, time consuming and disruptive (Niazi, Babar & Verner, 2010)
- Hence, not realizing the potential benefits
- To be competitive and win global contracts, firms must demonstrate that their software delivery process is mature (Sulayman, Urquhart, Mendes & Seidel, 2012)

Software Process Improvement (SPI) Involves (Humphrey, 1989)

- Assessing the maturity of current practices
  [Assessment frameworks, e.g. **CMMI**, SPICE, Bootstrap,..]
- Establishing implementation plans for achieving higher process maturity

The 5 Stages of Maturity Levels

[Assessed at Level 3 and above to win global contracts]



Maturity & the CMMI

- Maturity is defined as the degree to which a process is defined, managed, measured, and continually improved (Dooley et al., 2001)

- Capability Maturity Model Integration (CMMI)
  - The most popular SPI framework (Agrawal & Chari, 2007)

Research Questions

- What is the level of SPI awareness
  - in Canada?
  - in the English-speaking Caribbean?
- What is the level of SPI adoption
  - in Canada?
  - in the English-speaking Caribbean?
- What benefits are being realized from the use of SPI programs
  - in Canada?
  - in the English-speaking Caribbean?

Selection of Canada & ESC - both in the Commonwealth

- Convenience and association by the researcher to these environments
  - Canada & the ESC
- There is relatively little research in developing ways to effectively implement SPI programs (Niazi, 2012), with Canada and the ESC being no exception.

Motivation - Canada

- The Canadian software development domain is not greatly studied
- Canada was ranked at 12th in the Network Readiness Index behind the Republic of Korea and China (Bilbao-Osorio, Dutta, & Lanvin, 2013).
- The network readiness index seeks to evaluate the degree of a society's preparedness and readiness to take advantage of their ICT infrastructure (Dutta, Bilbao-Osorio, & Geiger, 2012).

Motivation - ESC

- There is little research in this domain in the ESC (Chevers & Duggan, 2007)
- Firms in the ESC have less capacity in comparison to firm in developed countries to absorb failed IS projects (Heeks, 2002)
- It was found that an overwhelming majority of software development firms in the ESC are not aware nor using any form of SPI programs (Chevers & Duggan, 2010).

Definition & Scope

- The English-speaking Caribbean refers to "members of the Caribbean community and common market (CARICOM) whose first language is English" (Duggan & Virtue, 2004).
- Five ESC countries were chosen for this study because they have established software development firms and these five countries accounted for 85% of the ESC population.
- They are Barbados, Guyana, Jamaica, St. Lucia, and Trinidad & Tobago
- The Network Readiness Index of these ESC countries is low and declining

Table 1: Network Readiness Index 2013

Rank	Country	Score	2012 Rank (out of 142)
1	Finland	5.98	3
2	Singapore	5.96	2
3	Sweden	5.91	1
4	Netherlands	5.81	6
5	Norway	5.66	7
7	United Kingdom	5.64	10
9	United States	5.57	8
12	Canada	5.44	9
13	Germany	5.43	16
18	Australia	5.26	17
21	Japan	5.24	18
26	France	5.06	23
39	Barbados	4.49	35
58	China	4.03	51
68	India	3.88	69
72	Trinidad and Tobago	3.87	60
85	Jamaica	3.74	74
90	Dominican Republic	3.62	87
100	Guyana	3.45	90
141	Haiti	2.58	142

Literature Review

- Improving the process used to deliver software products is one of the remedies to overcome the problem of poor quality software being delivered (Kituyi & Amulen, 2012)
- It is believed that a mature IS delivery process is the most influential factor in producing high quality software (SEI, 2010)
- The benefits of SPI programs are:
  - Reduced project cycle time; Reduced development cost
  - Improved staff productivity; improved customer satisfaction (Clarke & O'Connor, 2013)

Literature Review

- To be competitive in the global market and win contracts, firms must demonstrate that their software delivery processes are capable and mature (Sulayman, Urquhart, Mendes, & Seidel, 2012)
- It is assumed that software development firms in Canada and the English-speaking Caribbean would like to compete in the global market and make information technology (IT) a factor in economic development
- There are increasing pressure from clients for software developers to produce high quality software products (Chevers & Duggan, 2007)

Literature Review

- Many firms in developed and developing countries find most of the CMMI practices irrelevant and hard to implement (Mondragon, 2006)
- Many firms cannot afford the steep initial investment, high implementation cost, heavy human resource burden and time commitment in SPI implementation (Kituyi & Amulen, 2012)
- In most cases the objective of many firms in developing countries is to survive (Kituyi & Amulen, 2012) due to resource constraints, and so the adoption and implementation of SPI programs might be secondary

Literature Review

- Firms in developed countries usually have state-of-the-art technologies and IS development methods (Palvia & Hunter, 1996)
- But the uptake of SPI programs like the CMMI is low in both developed and developing countries (Clarke & O'Connor, 2013; Montoni, Rocha, & Weber, 2009; Niazi, 2012; Oktaba, 2006; Scott, Jeffery, Carvalho, D'Ambra, & Rutherford, 2001; Sulayman et al., 2012)
- Based on the constraints being experienced by developing countries, it is reasonable to expect different results in SPI adoption studies in developing countries in contrast to similar studies in developed countries (Kamhawi, 2007)

Methodology

- Both online and self-administered surveys were used
- For Canada – 344 online surveys were sent across the country via emails to IS project managers, managers, developers or administrators
- For the 5 ESC countries – Both online & self-admin surveys
- The unit of analysis was IS projects
- Individuals were asked to report on the state of the maturity of their firm's software development process
- The scaled survey items were 7-point likert-type questions anchored as (1) strongly disagree and (7) strongly agree

Methodology

- Canada
  - The sample frame was developed from the Canadian Company Capabilities database, personal referrals, as well as assistance from two Canadian IT/IS professional associations in which one Head Office was in Ottawa and the other in Toronto.
  - Ethical approval was received to conduct the survey and invitation letters with link to the online survey were sent to 344 persons through their email addresses.
  - A total of 69 responses were received and analyzed, giving a 20% response rate. Respondents included 54 males and 15 females

Methodology

- **ESC**
  - For the **online survey method**, 176 invitations were sent via email addresses to potential respondents in the five ESC countries
  - Only 13 were received and analyzed.
  - The **self-administered survey method** took the form of face-to-face sessions being held in the five countries with the targeted participants – IS project managers, analysts, developers and programmers.
  - 16, 14, 6, 5 and 1 participant attended the sessions in Jamaica, Guyana, Barbados, St. Lucia, and Trinidad & Tobago respectively
  - A total of 42 attendees at the 5 sessions in which participants were given the survey instrument to complete. All 42 instruments were completed at the face-to-face sessions
  - Hence the total completed survey instruments (both online and self-administered) was fifty-five (13 + 42 = 55)
  - This gave a 25% response rate (55/218 = 25%)
  - The profile of the 55 respondents was 40 males and 15 females
  - This included 27, 14, 6, 5 and 3 respondents from Jamaica, Guyana, Barbados, St. Lucia, and Trinidad & Tobago respectively.

Table 2: Awareness of SPI programs

[Expected the margin to be wider; With Canada being much higher]

Awareness	Percent (%) Canada	Percent (%) ESC
Yes	59.4	54.5
No	40.6	45.5

Table 3: Cross-tabulation of countries and awareness of SPI in the ESC

[Guyana being ranked #2 was a surprising result; Low response in T&T]

Country	Rank	Yes (%)
Jamaica	1	40.7
Guyana	2	22.2
St. Lucia	3	18.5
Barbados	4	14.8
Trinidad	5	3.7

Table 4: Use of SPI programs in Software Development

[Again expected the margin to be wider; With Canada being much higher]

Use of SPI	Percent (%) Canada	Percent (%) ESC
Yes	43	20
No	57	80

Table 5: Reasons for non-adoption of SPI programs

[Findings are consistent with the Literature]

Reasons	Rank Canada	Rank ESC
Time consuming	1	2
Lack of resources	2	1
Fear making SPI changes and having to deal with lengthy learning curves	3	-
Too costly	-	3
Cumbersome	-	4

Table 6: Analysis of SPI Benefits in Canada

[Findings are consistent with the Literature]

Factor	Rank (Descending Order)	Mean (n = 69)	Standard Deviation (n = 69)
SPI model improved software product quality	1	5.926	1.107
SPI model improved customer satisfaction	2	5.815	1.145
SPI model improved staff productivity	3	5.481	1.156
SPI model reduced development cost	4	5.185	1.272
SPI model reduced project cycle time	5	4.704	1.660
SPI model used in all IS projects	6	4.556	1.948

Table 7: Analysis of SPI Benefits in the ESC

[Findings are consistent with the Literature]

Factor	Rank (Descending Order)	Mean (n = 55)	Standard Deviation (n = 55)
SPI model improved software product quality	1	4.400	2.074
SPI model improved customer satisfaction	2	4.200	0.447
SPI model improved staff productivity	3	3.600	1.140
SPI model reduced development cost	3	3.600	1.342
SPI model reduced project cycle time	5	3.400	1.517
SPI model used in all IS projects	6	3.200	1.924

Conclusion

- SPI programs can increase the likelihood of producing high quality software products and provide a competitive advantage
- Before these benefits can be realized, SPI awareness and adoption needs to be increased from the current levels in Canada and the ESC
- The mean scores indicate that firms in Canada and the ESC who use SPI programs are realizing moderate benefits in areas such as reduced project cycle time and development cost, improved staff productivity and improved customer satisfaction
- Based on the moderate benefits being realized, it might be prudent for IS professionals in these environments to become more aware and knowledgeable of SPI programs and their benefits

Conclusion

- A limitation of the study was the small sample size which can affect the generalibility of the results
- Future research could include a larger sample for the quantitative analysis and this could be complemented with interviews to ascertain deeper insights in this area of SPI adoption in Canada and the ESC
- A longitudinal study could be conducted to assess the progress being made in the areas of SPI awareness and adoption in Canada and the ESC software development firms
- If such progress is made these firms could win global contracts, which can enhance growth & development


Questions?


Thank You!

Characteristics of Developing Countries

- Scarcity of technical experts due to migration (International Monetary Fund, 2006) [70% per year migrate]
- Unavailability of IS specialists (Thong et al., 1996)
- Heavy reliance on imported IT products and solutions (Bhatnagar, 2000)
- Resource poverty in finance, labor, equipment and material (Berisso & de Vries, 2010)
- Highly centralized structures, with the CEO (who might not be an IS personnel) making most of the important IS/IT decisions (Vreede et al., 1999)
- Cultural problems such as aversion to change and low productivity (Herrera & Ramirez, 2003).