

# The Adoption and Benefits of Agile Software Development Methods in Jamaica

**Delroy A. Chevers**

The University of the West Indies

Delroy.chevers@uwimona.edu.jm

**Chevonnese Chevers Whyte**

The University of the West Indies

emailme@chevonnesewhyte.com

## Abstract

Studies have demonstrated that most information systems projects fail due to people problems. Agile software development methods were introduced in an effort to resolve this problem. It relies on people and their creativity during system development rather than processes and the maturity of firms. Research has found that the adoption of agile methods in software development is becoming very popular. However, there is an appeal in the literature for more empirical studies of agile software development. This study examined the adoption and benefits of agile methods in Jamaican software development firms. The results showed that 53% of the firms surveyed are using agile methods, with SCRUM being the main method, and the top benefits being improved customer satisfaction, improved productivity of teams and speeding up the developmental process. The average uptake of agile methods in Jamaican firms would support the claim for a longitudinal study to track the adoption trend.

## Keywords

Agile methods, adoption, information systems success, Jamaica, software development firms

## Introduction

The Standish Group (2013) report shows that 43% of information systems (IS) projects are challenged. A project that is challenged is one that is delivered late, over budget and delivered with less than the required features and function (Standish Group, 2013). For this study, we will consider a project that is delivered with less than the required features and functions to be a failure. Studies have shown that most information systems projects fail due to people problems (Ceschi, Sillitti and Succi, 2005) and the fact that software development is a complex activity in which frequent conflict arises (Barrett and Oborn, 2010). Communication problems between development teams and users/customers are the main reasons for conflicts and ultimately project failures (Boehm, 2002). In fact, the literature refers to the factors that can enhance the successful execution of IS projects with executive management support being number one, and agile methods being ranked in the top six (Standish Group, 2013).

Agile software development methods were introduced in an effort to resolve the problem of poor communication. It relies on people and their creativity during system development rather than processes and the maturity of firms (Nerur, Mahapatra and Mangalaraj, 2005). In this approach customers and key users are no longer at the periphery of software development, but actively shaping and guiding the evolution of the delivered software product (Dingsoyr, Nerur, Balijepally and Moe, 2012). The guiding tenets of agile methods as distilled by Cockburn and Highsmith (2001) states that "If the people on the project are good enough, they can use almost any process and accomplish their assignment. If they are not good enough, no process will repair their inadequacy" (p. 131). It is a collaborative development approach

in which people are afforded privileges over processes that formally constrained them (Dingsoyr et al., 2012). These methods seek to develop software quickly, in an environment of rapidly changing requirements and aim to deliver software of high-quality which provides value to customers (Balijepally, Mahapatra, Nerur and Price, 2009).

Studies have found that the adoption of agile methods in software development is becoming very popular (Ahmed, Ahmad, Ehsan, Mirza and Sarwar, 2010) because these methods can improve the management of the development process and developer/user relationships (Ceschi et al., 2005). Methods such as Extreme programming (XP), SCRUM, Feature-driven development, Adaptive software, Crystal family of methods and Dynamic software development method, Lean software development are all members of the agile family (Dyba and Dingsoyr, 2008). It was discovered in a survey that 41% of software development projects have adopted one of the agile methods, and agile techniques are being used in 65% of such projects (Ambler, 2006). A survey conducted with 240 students, discovered that 78% of the respondents surveyed believed that XP can improve the productivity of small project teams, 76% of the respondents suggested that XP can improve the quality of programming codes and 65% of the respondents would recommend XP to their respective workplace if allowed (Melnik and Maurer, 2005).

Although agile methods (in particularly XP) have been gaining in popularity, there is an appeal in the literature for more empirical studies of agile software development (Dyba and Dingsoyr, 2008), especially in regards to its adoption or non-adoption (Cao, Mohan, Xu, and Ramesh, 2008) in various contexts. It is felt that most of the claims of agile methods effectiveness is anecdotal (Melnik and Maurer, 2005). In addition, there is relatively little research in this area in Jamaica. Based on the fact that most software development firms in Jamaica are in Kingston the country's capital; this study examined the adoption and benefits of agile methods in Kingston-based Jamaican software development firms. The three research questions are:

1. What is the adoption rate of agile methods in Kingston, Jamaica?
2. What are the main agile methods used in Kingston, Jamaica?
3. What are the main benefits derived from agile methods in Kingston, Jamaica?

It is hoped that the findings of this study will assist both IS professionals and practitioners with the production and delivery of more successful information systems. This by extension can bridge the digital distance (Heeks, 2002) between Jamaica and the developed world. Furthermore, the study could guide policy makers in the formulation of the national IT policy in Jamaica, in the quest for economic growth and development.

## **Literature Review**

The literature states that technology, process and people are major determinants of successfully deployed IS projects with the required features and functions (Espinosa-Curiel, Rodriguez-Jacobo and Fernandez-Zepeda, 2013). But this study is concern about the people paradigm of software development, which has led to the birth of agile methods (Highsmith, 2001). Advocates of the agile methods of software development believe that many of the assumptions of the process paradigm are flawed (Highsmith and Cockburn, 2001; MacCormack, 2001). Advocates of the process paradigm believe that a mature process increases the likelihood of producing high-quality software products (SEI, 2010). The methods in this paradigm are called plan-driven methods. Agile proponents on the other hand argue that it is not possible to plan IS projects well in advance, especially requirements definition. This is due mainly to the many uncertainties in software development (Dingsoyr et al., 2012). It is further believed that project success should not be merely determined by the degree of conformance to the initial project plan but by the ability of the delivered software product to add business value.

There can be many changes and new development from the initial stage of the development cycle to deployment. Some of the changes can relate to changes within the business, as well as changes within the software industry which include business processes, requirement definitions and technological innovations. Because the software industry is so volatile, freezing project scope early in the development cycle, which is customary in the process paradigm can be suboptimal (Duggan and Chevers, 2008). This is against the background that the main goal of software development firms is to satisfy users/customers at the time of delivery with value-adding software products.

Developing software in an iterative manner, as is the case with agile methods, allows the project team to adapt quickly to changing business processes and changing software requirements (Cohen, Lindvall and Costa, 2004). In general, some of the techniques employed in agile methods other than iterative development as posited by Beck (2000) are pair programming (two developers coding side by side), small and frequent releases of software, rigorous code testing and frequent consultation with users (co-located teams with developers and users). It is strongly believed that this close collaboration between developers and users can enhance immediate and meaningful decision making in the development cycle because agile teams are empowered to make decisions (McAvoy and Butler, 2009).

Proponents of agile methods are guided by the Agile Manifesto. The manifesto provides the fundamental principles and beliefs of these methods as distilled by Vinekar, Slinkman and Nerur (2006) which are:

- The ingenuity and competence of people and their interactions and collaborations are of greater value than tools and processes. This principle discounts both technology and process as key determinants of project success
- Delivering a high-quality working software product to the customer is more important than producing heavy documentation
- The active participation and constant involvement of the user in systems development yields greater benefits than the fulfillment of predetermined requirements specified in a contract
- Recognizing the inevitability of change and embracing it, is better than extensive planning in a very turbulent software industry.

Although agile methods have been claimed to be useful and have been gaining in popularity (Ahmed et al., 2010), some scholars have criticized these methods. Merisalo-Rantanen, Tuure and Matti (2005) posit that agile development is nothing new because these principles have been in the software development industry for many years. McBreen (2003) in his criticism states that the lack of focus on architecture in agile methods is bound to create sub-optimal design-decisions. He went further to state that there is little scientific evidence to support the claims made by the agile community. Furthermore, the reliance of agile methods on skilled and talented software developers can be a limitation. Finally, Cohen et al. (2004) posit that agile methods are suitable for small teams working on small projects in small firms.

Small firms are defined as having less than fifty employees and an annual turnover of up to ten million euros (European Commission, 2005). Based on this definition most software development firms in developing countries would be classified as small. Based on the small size of these firms in developing countries, it might be difficult for them to embrace some of the agile practices like co-location of developer-user and pair programming. The objective of most small firms in developing countries is to survive (Kituyi and Amulen, 2012) due to resource constraints. Developing countries experience constraints such as the lack of finance, shortage of human resource, heavy reliance on imported IT solutions and foreign exchange shortage (Avgerou, 2008; Berisso and de Vries, 2010; Bhatnagar, 2000; Kodakanchi, Kuofie, Abuelyaman and Qaddour, 2006; Niazi, 2012).

Jamaica, a developing country in which most of the software development firms are small, has a debt to GDP ratio of 147% (Wynter, 2014). This ratio is one of the highest in the world (Williams and Jones, 2010). Over the years, Jamaica has depended on agriculture, bauxite mining and tourism as its main sources for economic development. These three industries were seen as the means to overcome the high debt ratio, as well as the country's high unemployment rate which stood at 14.2 in 2014. In fact, tourism is the main foreign exchange earner for Jamaica, accounting for 25% of the jobs and 10% of the GDP (Jamaica Travel Secrets, 2013), with small hotels comprising more than 65.4% of hotels in the Caribbean region (Cresser, 2014). These small hotels have earned approximately US\$1.5 billion during the period 2009-2010. In 2012, tourist arrivals in Jamaica contributed close to US\$4 billion to the economy (Jamaica Travel Secrets, 2013). Hopes were high that tourism would enable Jamaica to address their balance of payment woes (Hayle, 2011). But the developmental benefits that tourism was expected to deliver have failed to materialize (Singh, 2008).

In fact, the three industries – tourism, agriculture and bauxite mining - that had contributed greatly to Jamaica's economic development have been declining in recent years. For example, crude bauxite production in 2014 declined by 14% over the corresponding period in 2013. In response to bauxite and the

other industries declines, the political directorates have decided to leverage information and communication technology (ICT) as the alternate means to achieve economic growth and development in Jamaica, with off-shore IT contracting being the main strategy to achieve such outcomes.

Jamaica has made immense strides in developing its ICT infrastructure. Relatively speaking the country is a competitive and attractive location and has become the leading centre in the English-speaking Caribbean (ESC) with over thirty ICT and business process outsourcing companies employing approximately 11,500 employees. The information technology (IT) industry in the USA alone employed 1.7 million workers in 2007 and the projected global spending in the industry is expected to be US\$4.2 trillion in 2019. There is huge potential due to the size of the global IT market. As a result, greater strides can be made in Jamaica to enter the global IT market. This is possible bearing in mind the fact that Jamaica's literacy rate is high at 87.9%. There are many literate persons who are unemployed. With this high literacy rate, it is reasonable to assume that potential employees will have the ability to learn the global IT market, the business and relevant information technology concepts.

However, it is not only important to enter the market but software development firms must be competitive to win global contracts. These companies must develop high-quality and successful software products (Sulayman, Urquhart, Mendes and Seidel, 2012). Based on the competitive nature of the software industry, it is imperative that IS professionals and practitioners in Jamaica become more familiar about the application and benefits of software production methods, including agile, plan-driven, or hybrid forms of these methods.

All methods have been claimed to enhance the delivery of high-quality software products. Notwithstanding, it has been argued that the utilization of agile methods in software development can improve the communication and relationship between developers and users (Ceschi et al., 2005). These conditions can increase the likelihood of producing high-quality and successful software products, which by extension can provide business value. It is also claimed that agile methods can improve programming code (Melnik and Maurer, 2005). In addition, the literature makes mention that agile methods can reduce development cost by 26% (Kratzert, Broquist and Ottosson, 2013).

It is for these reasons that agile methods are gaining popularity. It was discovered in a survey conducted in the US and Europe that 14% of software firms was using agile methods. The survey went further to show that 49% of the firms that were aware of agile methods were interested in adopting them in the near future (Dyba and Dingsoyr, 2008).

An earlier study with 45 students discovered that the majority of the students experience with the use of extreme programming were positive (Melnik and Maurer, 2002). In summary, the literature claims that agile methods can improve software quality, reduce time to market, enhance productivity, as well as fulfill the needs and expectations of users (Ahmed et al., 2010). Based on these findings, software development firms are increasingly recognizing the need to adopt and use agile methods whenever possible (Lyytinen and Rose, 2006).

## **The Methodology**

This was a quantitative study in which the unit of analysis was individuals who were expected to provide their perception regarding the execution of an information systems projects in their organizations. A self-administered survey approach was taken among students at the University of the West Indies who were pursuing their Master in Information Systems. Although the study used a convenient sample, precautionary measures were taken to ensure that all survey respondents were information systems professionals who worked at a software development firm in Jamaica, and recently implemented (less than eighteen months) an information systems project.

The survey items were newly developed questions by the authors. As a result, a pilot test was conducted with five information systems lecturers to assess the validity (in particular face validity) and reliability of the survey items. Upon completion minor adjustments were made. A noteworthy change was the inclusion of a definition of agile methods. This change was made so that all respondents would have a common understanding about agile methods.

The resulting survey instrument had twenty-one questions which included demographic data, firm data and the survey items. Nine of the survey items regarding the benefits of agile development were 7-point

Likert-type scaled questions with 1 being strongly disagreed and 7 being strongly agreed. At the end of a class the students who were not IS professionals (i.e. IS project team members, network specialists, software developers, programmers, software analysts, database administrators, team leaders and business analysts) were asked to leave the classroom. The survey instrument was given to the remaining students to be completed. This was done in two MSc in information systems classes – first year and second year classes. All together sixty questionnaires were distributed but only thirty-two were analyzed due to missing data and/or non-completion of the instrument. Some students remained in the classroom but did not complete the instrument. This gave a 53% response rate. It is believed that if an incentive was offered the response rate would be much higher.

The profile of the survey respondents were seventeen males and fifteen females, all having average years of service in the software development industry of 4.14 years. The main positions held in the respective projects were team members, network specialists, software developers, programmers, software analysts, database administrators, team leader and business analysts. However, it is important to note that many of the respondents played various roles (positions) in the execution of the reported projects. This could be attributed to the resource constraints being experienced by firms in developing countries (Niazi, 2012).

## Analysis and Discussion

Microsoft Excel was used as the analytical tool to conduct the inferential statistics. The study found that the over whelming majority (78.1%) of the software applications being developed were for in-house use, with a small amount developed for sale. This finding is not surprising because software development firms in Jamaica might find it difficult to win global contracts because in general their process maturity is low (Chevers, 2014). Another factor which might influence Jamaican firms to implement more in-house over for-sale development projects is due to the fact that Jamaica is ranked at 85<sup>th</sup> out of 144 countries in the global network readiness index (Bilbao-Osorio, Dutta and Lanvin, 2013). This ranking is an indication that Jamaica might not be ready to penetrate the global software market. The network readiness index is the degree of a society's preparation and readiness to use and take advantage of an available ICT infrastructure (Dutta, Bilbao-Osorio and Geiger, 2012). In addition, 70% of tertiary graduates migrate annually to developed countries (International Monetary Fund, 2006). This trend would negatively affect the availability of highly skilled software developers in Jamaica.

Further results regarding the adoption of agile methods in Jamaican firms are shown in Table 1. The results indicate that a slight majority of respondents (53.1%) were using agile methods and 46.9% were not. This 53.1% in a developing country is somewhat surprising because it is higher than the 41% that was found using agile methods in a developed country (Ambler, 2006). The main reason could be the small sample size. Another possible explanation for this difference is the fact that these respondents were young and educated developers with 4.14 years of service in the industry. It is reasonable to assume that they are quite knowledgeable and curious about the latest and various software development methodologies and possibly quite influential in utilizing these methods in their organizations.

Adoption of agile	Number	Percent (%)
Yes	17	53.1%
No	15	46.9%

**Table 1. Adoption of agile methods in software development**

The literature makes reference to the popularity of extreme programming (Melnik and Maurer, 2005). As a result the finding of SCRUM being ranked as number one as shown in Table 2 is surprising. Further investigation is needed to explain the cause of SCRUM being popular in Jamaica.

No.	Method	Number of Respondents
1	SCRUM	11
2	Extreme Programming (XP)	5
3	Feature Driven	2

**Table 2. Agile methods used**

It is shown in Table 3 that reduced development time, user involvement and response to changes are the top 3 reasons to adopt agile methods. These reasons are consistent with the literature.

No.	Reason	Number of Respondents
1	Reduced development time	9
2	User involvement	2
3	Response to changes in the environment	2

**Table 3. Reasons to adopt agile methods**

The results of the scaled survey items are shown in Table 4. The results revealed that the mean scores are above the mid-point on the 1-7 likert scale. Using the mean scores as the basis for analysis, it shows that the benefits of agile methods in Jamaica are:

1. The ability to improve customer satisfaction
2. Speed up the development process
3. Improve the productivity of teams

The lowest mean score (4.45) is above the mid-point and this score is associated with reduced development cost.

## Conclusion

The initial intention of the study was simply to ascertain the rate of adoption (%) of agile methods in Jamaica and the associated benefits. Hence a quantitative approach was taken. However, based on the small sample size, a follow-up qualitative study should have been conducted. It is recommended that a qualitative study be conducted in future research. The limitations of the study are the small sample size and the utilization of students who are enrolled in an Information Systems Master Program as respondents to the survey.

The results showed that 53% of the firms surveyed are using agile methods in software development projects in Kingston, Jamaica, with SCRUM being the main method. The top benefits were found to be improved customer satisfaction, speeding up the development process and improved productivity of teams. Based on similar norms and firm sizes, it is expected that other software development firms in the English-speaking Caribbean could experience the same benefits. However, based on the small sample size and the fact that the study was conducted on Kingston-based Jamaican firm, then these findings cannot be generalized. Because the uptake of agile methods in Jamaican firms could be considered average at 53%, it is reasonable to support the claim for a longitudinal study to track the adoption rate over time.

Factor	Mean (n = 32)	Standard Deviation (n = 32)
The use of agile method improves software quality	4.68	1.46
The use of agile method reduces project cycle time	5.05	0.95
The use of agile method reduces development cost	4.45	1.30
The use of agile method improves the productivity of teams	5.18	1.14
The use of agile method improves customer satisfaction	5.55	1.26
I personally like pair programming	4.68	1.13
I believe pair programming speeds up the development process	5.18	1.01
I believe using agile methods improves the quality of code	5.09	1.02

**Table 4. Benefits of agile software development**

In addition, there is the need to conduct interviews with software developers in these firms to seek deeper insights, as well as to ascertain the cause of SCRUM being ranked as the main agile method and agile methods reducing development cost being ranked as the lowest benefit. Future research could explore the adoption and benefits of various hybrid forms of agile and plan-driven methods. The findings of these studies can assist with the development and deployment of more successful systems, as well as assist in the formulation of the national IT policy in Jamaica. These conditions are critical for Jamaica that is seeking to use IS/IT as the main medium for economic development. It is equally important that a larger sample size be used to make the results more generalizable.

## REFERENCES

- Ahmed, A., Ahmad, S., Ehsan, N., Mirza, E., & Sarwar, S. Z. 2010. "Agile software development: Impact on productivity and quality," in *Proceedings of the 5th IEEE International Conference on Management of Innovation and Technology*, Singapore.
- Ambler, S. 2006. "Agile adoption rate survey". Retrieved May 4, 2014, from <http://www.serena.com/docs/repository/solutions/intro-to-agile-devel.pdf>
- Avgerou, C. 2008. "Information systems in developing countries: A critical research review," *Journal of Information Technology* (23), pp. 133-146.
- Balijepally, V., Mahapatra, R., Nerur, S. & Price, K. 2009. "Are two heads better than one for software development? The productivity paradox of pair programming," *MIS Quarterly* (33:1), pp. 91-118.
- Barrett, M. & Oborn, E. 2010. "Boundary object use in cross-cultural software development teams," *Human Relations* (63:8), pp. 1199-1221.
- Beck, K. (2000). "Extreme Programming Explained: Embrace Change," Boston: Addison-Wesley.
- Berisso, Z. A., & de Vries, W. T. 2010. "Exploring characteristics of GIS adoption decisions and types of induced changes in developing countries: The case of Ethiopia," *The Electronic Journal on Information Systems in Developing Countries* (40:2), pp. 1-16.
- Bhatnagar, S. (2000). "Social Implications of Information Communication Technology in Developing Countries: Lessons from Asian Success Stories," *The Electronic Journal of Information Systems in Developing Countries* (1:4), pp. 1-9.
- Bilbao-Osorio, B., Dutta, S., & Lanvin, B. (2013). "The global information technology report 2013," *World Economic Forum*, pp. 1-383.
- Boehm, B. (2002). "Software engineering is a value-based contact sport," *IEEE Software*, pp. 97-101.

- Cao, L., Mohan, K., Xu, P., & Ramesh, B. (2008). "A framework for adapting agile development methodologies," *European Journal of Information Systems* (18), pp. 332-342.
- Ceschi, M., Sillitti, A., & Succi, G. (2005). "Project management in plan-based and agile companies," *IEEE Software*, pp. 21-27.
- Chevers, D. A. (2014). "Key factors of process maturity in English-speaking Caribbean firms," *RAE - Revista de Administracas de Empresas* (54:3), pp. 322-329.
- Cockburn, A., & Highsmith, J. (2001). "Agile Software Development: The People Factor," *Computer* (34:11), pp. 131-133.
- Cohen, D., Lindvall, M., & Costa, P. (2004). "An introduction to agile methods," *Advances in Computers* (62), pp. 1-26.
- Cresser, H. (2014). "Prospects in Hospitality Innovation," in *Proceedings of the 3rd International Tourism Conference*, Montego Bay, Jamaica.
- Dingsoyr, T., Nerur, S., Balijepally, V. & Moe, N. (2012). "A decade of agile methodologies: Towards explaining agile software development," *The Journal of System and Software* (85), pp. 1213-1221.
- Duggan, E. W., & Chevers, D. A. (2008, May 18-20, 2008). "Agile systems development versus process-centricity: A conflict of priorities?" in *Proceedings of the International Conference on Information Resources Management*, Niagara Fall, Ontario, Canada.
- Dutta, S., Bilbao-Osorio, B., & Geiger, T. (2012). "The Global Information Technology Report 2012," *World Economic Forum*, pp. 3-22.
- Dyba, T., & Dingsoyr, T. (2008). "Empirical studies of agile software development: A systematic review," *Information and Software Technology* (50), pp. 833-859.
- Espinosa-Curiel, I. E., Rodriguez-Jacobo, J., & Fernandez-Zepeda, J. A. (2013). "A framework for evaluation and control of the factors that influence the software process improvement in small organizations," *Journal of Software: Evolution and Process* (25), pp. 393-406.
- European Commission, T. (2005). "The new SME definition: User guide and model declaration," *Enterprise and Industry Publications*, pp. 1-51.
- Hayle, C. (2011). "Review of the hospitality and Tourism Sector in Jamaica," Unpublished manuscript.
- Heeks, R. (2002). "Information systems and developing countries: Failure, success, and local improvisations," *The Information Society* (18), pp. 101-112.
- Highsmith, J. (2001). "Agile Methodologies: Problems, Principles, and Practices: Cutter Consortium," Information Architects Inc.
- Highsmith, J., & Cockburn, A. (2001). "Agile Software Development: The Business of Innovation," *Software Management* (34:9), pp. 120-122.
- International Monetary Fund. (2006). "Major Brain Drain," *Jamaica Daily Gleaner*.
- Jamaica Travel Secrets. (2013). "The economy of Jamaica: A quick overview," *Market, Investment and Current Issues*, pp. 1-4.
- Kituyi, G. M., & Amulen, C. (2012). "A software capability maturity adoption model for small and medium enterprises in developing countries," *The Electronic Journal on Information Systems in Developing Countries* (55:1), pp. 1-19.
- Kodakanchi, V., Kuofie, M. H. S., Abuelyaman, E., & Qaddour, J. (2006). "An economic development model for IT in developing countries," *The Electronic Journal of Information Systems in Developing Countries* (28:7), pp. 1-9.
- Kratzert, T., Broquist, M., & Ottosson, J. (2013). "Agile software development hits the major league," *AT Kearney*, pp. 1-10.
- Lyytinen, K., & Rose, G. M. (2006). "Information system development agility as organizational learning," *European Journal of Information Systems* (2:15), pp. 183-199.
- MacCormack, A. (2001). "Product-Development Practices that Work: How Internet Companies Build Software," *MIT Sloan Management Review* (42:2), pp. 75-84.
- McAvoy, J., & Butler, T. (2009). "The role of project management in ineffective decision making within agile software development projects," *European Journal of Information Systems* (18), pp. 372-383.
- McBreen, P. (2003). "Questioning extreme programming," Boston, MA, USA: Pearson Education.
- Melnik, G., & Maurer, F. (2002). "Perceptions of agile practices: A student survey," in *Proceedings of the 2nd XP Universe and First Agile Universe Conference on Extreme Programming and Agile Methods*, Springer-Verlag, London, UK.
- Melnik, G., & Maurer, F. (2005, May 15-21, 2005). "A cross-program investigation of students' perceptions of agile methods," in *Proceedings of the 27th International Conference on Software Engineering*, St. Louis, Missouri, USA.



- Merisalo-Rantanen, H., Tuure, T., & Matti, R. (2005). "Is extreme programming just old wine in new bottles: A comparison of two cases," *Journal of Database Management* (16:4), pp. 41-61.
- Nerur, S. R., Mahapatra, R., & Mangalaraj, G. (2005). "Challenges of migrating to agile methodologies," *Communications of ACM* (48:5), pp. 73-78.
- Niazi, M. (2012). "An exploratory study of software process improvement implementation risks," *Journal of Software: Evolution and Process* (24), pp. 877-894.
- SEI (2010). "CMMI for development, version 1.3," Carnegie Mellon University, Software Engineering Institute.
- Standish Group, T. (2013). "Chaos Manifesto 2013: Think big, act small," *The CHAOS Manifesto*, pp. 1-48.
- Sulayman, M., Urquhart, C., Mendes, E., & Seidel, S. (2012). "Software process improvement success factors for small and medium Web companies: A qualitative study," *Information and Software Technology* (54), pp. 479-500.
- Vinekar, V., Slinkman, C. W., & Nerur, S. (2006). "Can agile and traditional systems development approaches coexist? An ambidextrous view," *Information Systems Management* (23:3), pp. 31-40.
- Williams, D., & Jones, O. (2010). "Factors associated with longevity of small, family-owned firms," *International Journal of Entrepreneurship* (14), pp. 37-56.
- Wynter, B. (2014). "Jamaica's Current Economic Programme," *Jamaica Manufacturers' Association 2014 Economic Forum*, pp. 1-5.