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A conceptual framework for scaled agile success

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Abstract: This article presents a conceptual framework to determine the success of organisations scaled agile endeavours. Different processes and perceived indicators from the three main levels of agile scaling frameworks were studied. The processes were examined to determine whether they contribute in achieving the perceived success indicators. A quantitative research method was employed for data collection and analysis. Pearson's correlations and multiple linear regressions were used to test and construct the final conceptual framework. Key findings revealed that there are processes currently implemented that do not contribute to the achievement of the perceived indicators. Strategy and investment funding is the driving process at the portfolio level, continuous exploration drives the program level while building, testing and deploying of a software product drive the team level. This research contributes to the body of knowledge with regards to scaled agile, specifically on how to measure scaled agile success.

Keywords: scaled agile; agile methods; software project success; SPS; multiple linear regression; MLR; processes; perceived indicators.

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Biographical notes: Lucas Khoza interest in research is more on project management with a focus on challenges and benefits around agile adoption within large and small organisations. Since agile was initially intended for small projects and now it is being implemented within large projects, so he is looking at how agile is adopted in large and complex projects as compared to small projects. He also focus on IT project success rate and knowledge sharing among team members within a project.

Carl Marnewick is a Professor with the University of Johannesburg, Johannesburg, South Africa. He heads up the IT Project Management Knowledge and Wisdom Research Cluster that focuses on research in IT project management including governance, auditing and assurance, complexity, IT project success, benefits management, sustainability, and agile project management benefits.

1 Introduction

Agile was initially developed for small software projects and collocated teams (Dikert et al., 2016). The benefits of agile adoption such as flexibility and short delivery times, has led many large organisations to adopt agile at scale (Paasivaara et al., 2018; Paasivaara and Lassenius, 2014). These large-scaled adoptions help organisations that implement large software projects and looking to improve the success of their software projects. Organisations are pressured to improve the delivery of their software projects by using frameworks to assist in the delivery of quality final software projects. Hence, the adoption of scaled agile has been seen as a possible solution (Paasivaara et al., 2018). There has been several studies trying to address the issue of measuring software project success. Software project success was traditionally measured using the triple constraint of time, cost and scope. However, it is no longer effective if business objectives are not considered (Thomas and Fernández, 2008; Todorović et al., 2015). Marnewick et al. (2017) proposed a framework for measuring project success with focus on project management success and product success. Bannerman (2008) and Bannerman and Thorogood (2012) proposed a framework that provides some insights on how to measure project success from the process success level up to the strategic success level. However, none of the existing frameworks cater for measuring the success of scaled agile. Hence, there is a need for a conceptual framework to measure the success of scaled agile. The focus on this article is on large software projects. To develop the conceptual framework for scaled agile success, different processes and perceived indicators were determined from the literature review. Thereafter, the processes at each level were used to determine how much they contribute in achieving the perceived indicators. This process helped in ensuring that only the processes that contribute to the achievement of the perceived indicators were included in the revised conceptual framework. The main research question that this study tries to answer is how should the success of scaled agile be measured? To achieve this, it is important to first understand the processes and perceived indicators and second to determine the satisfaction levels. The following sub-research questions are identified.

1 Which processes can be implemented at the portfolio, program and team levels to ensure scaled agile success?

2 Which perceived indicators are used to measure the success of scaled agile at the portfolio, program and team levels?

3 How satisfied are software developing organisations with the processes that are implemented at the portfolio, program and team levels to ensure scaled agile success?

4 How satisfied are software developing organisations with the perceived indicators that are used to measure the success of scaled agile at portfolio, program and team levels?

This article is structured as follows: Section 2 discusses an in-depth literature review with focus on the different processes and perceived indicators performed at the portfolio, program and the team levels. The research methodology is discussed in Section 3. Section 4 presents the data analysis and interpretation. Lastly, Section 5 discusses the conclusions and highlights future research avenues.

2 Literature review

There are different frameworks for scaling agile including Rage, Spotify, Nexus, Scrum of Scrums, Scaled Agile Framework (SAFe), Large-Scale Scrum (LeSS) and Disciplined Agile Delivery (DAD) (Alqudah and Razali, 2016; Turetken et al., 2017). The most adopted frameworks are SAFe, DAD and LeSS (Turetken et al., 2017; Paasivaara et al., 2018; VersionOne Inc., 2020). Most companies have adopted SAFe (27%), while LeSS and DAD are both 6% and 4% respectively (VersionOne Inc., 2020; Paasivaara et al., 2018). The three mostly adopted agile scaling frameworks are adopted to address project management related challenges including people management (Heikkilä et al., 2015). However, not much is revealed on how organisations can determine the success of their scaled agile endeavours (Kersten, 2018). SAFe 5.0 has two main levels, viz.

1 the essential level which consist of both the team and the program levels

2 the portfolio level.

The team level consists of product owners, developers, testers and scrum masters. The team is responsible to work on their user stories in the team Backlog (Paasivaara et al., 2018; Turetken et al., 2017; van Leeuwen, 2015). At the program level, the product manager, systems architect and the business owners establishes a time dependent vision so that the entire team is aware why they are working on a specific product. This vision serves as an input to the program backlog with features to meet both functional and non-functional user stories. The vision will also set a road map to develop a product within the specified time frame within the agile release train (ART) (Paasivaara, 2017). When the ART is completed, the team then releases shippable product increment (SPI) (Turetken et al., 2017; van Leeuwen, 2015). At the portfolio level, the product portfolio management (PPM) which includes the epic owners, enterprise architects, value stream owners and the portfolio managers are tasked to manage the portfolio. The PPM is responsible for all strategic and governance of the portfolio (Heising, 2012). Metrics such as lean portfolio metrics, portfolio Kanban board and the balanced score card are included. Since this is a strategic level, the metrics are needed for the allocation of funds in different value streams and ART (van Leeuwen, 2015). The goal of this article is not to improve on the existing agile scaling frameworks, but to develop a conceptual framework for scaled agile success. To achieve this goal, processes and perceived indicators for scaled agile success were determined from the literature review. The next section discusses the processes and the perceived indicators for scaled agile success at the portfolio, program and the team levels.

2.1 Processes and perceived indicators for scaled agile success

2.1.1 Portfolio level

SAFe, as the most adopted framework, is used as the basis for determining the success of scaled agile endeavours. SAFe covers all three different levels (portfolio, program and team) making sure that software projects are successfully delivered (Poth et al., 2020, Mikhieieva and Stephan, 2020). At the portfolio level, value streams are identified, and this supports the success of software projects from the team level (Mikhieieva and Stephan, 2020). Value streams are a sequence of steps used by an organisation to determine solutions that deliver value to customers (Scaled Agile Inc., 2018).

Organisations strive to ensure that the value streams are identified with interfaces at the boundary that include external partners. The value streams make it possible for organisations to be sustained and have a competitive advantage. Portfolio optimisation is an important process to ensure that only the portfolios that meet the strategic objectives of the organisation are selected (Knaster and Leffingwell, 2018, Scaled agile Inc., 2018). Stakeholder engagement is of utmost importance because it ensures that different mindsets are involved in establishing standards for quality management (Poth et al., 2020). Business and strategic value is generated internally from team members and externally from customers and this is only achieved by teams working together (Poth et al., 2020, Mikhieieva and Stephan, 2020). The main goal of all the processes implemented at the portfolio level is to provide business and strategic value to both internal and external partners (Mikhieieva and Stephan, 2020, Scaled agile Inc., 2018).

Due to competition, agility is fostered by organisations to ensure fast service delivery of software products to customers (Horlach et al., 2019). Therefore, the software products are balanced with the overall organisation's strength (Knaster and Leffingwell, 2018). The portfolio level should respond rapidly to change ensuring that the software projects developed at the team level are aligned with the overall organisations' strategy. The portfolio maximises the business value and the alignment between the portfolio and the teams. This is done by engaging all stakeholders across the different levels from business and information technology (IT) in the entire portfolio management process (Horlach et al., 2019). The work completed at the team level needs to be aligned and integrated in the entire enterprise level (Mucambe et al., 2019). The portfolio level aligns the program level with the business strategy and investment funding alongside the value streams. A high level of governance is needed for the management of the portfolio level. This will also ensure that the goals and the objectives of the portfolio are met and benefits are realised (Mucambe et al., 2019). The portfolio level guides the organisations in achieving its mission with focus on strategic decisions that could bring value to the entire organisation. The portfolio level maximises the financial value of the portfolio by identifying value streams and links the portfolio to the organisations' strategy through investment themes (Turetken et al., 2017, Knaster and Leffingwell, 2018). Since the portfolio level is a strategic level (Scaled Agile Inc., 2018, Knaster and Leffingwell, 2018), the final products should have an impact on the markets, industries, competitors, investors and regulators. These impacts serve as indicators of success at this level (Bannerman and Thorogood, 2012; Scaled Agile Inc., 2018). The individual software projects' success, from the team level, influences the success of the portfolio level (Mucambe et al., 2019; Scaled Agile Inc., 2018). The portfolio level encapsulates all processes to provide funding and governance strategies to meet strategic objectives of the organisations.

2.1.2 Program level

At the program level, the development teams are organised within ART which are responsible for delivering a continuous flow of incremental releases of value (Knaster and Leffingwell, 2018, Razzak et al., 2018). An ART is responsible to deliver the required software products at incremental levels to the customers. At the program level, features and enablers are discovered and developed that are required to realise the strategic objectives of the organisation (Scaled agile Inc., 2018). The release train engineer (RTE) is responsible for optimising the flow of the value through program

Kanbans, program increment (PI) planning and inspect and adapt workshops (Razzak et al., 2018). The software development team is formed to establish and support continuous integration, continuous exploration, testing and continuous deployment of the software project (Scaled agile Inc., 2018, Turetken et al., 2017). The foundation of the program level is the PI planning which provides a cadence for the ART. The system demo measures the ART's progress which is done at the end of each iteration (Knaster and Leffingwell, 2018). This system demo includes the demonstration of a fully integrated features from different teams (Neve et al., 2017). During the system demo, all train's stakeholders may provide feedback on how the software project can be improved and the train to stay on its course. It is a goal for programs to ensure that they comply with all standards of the organisation. This will ensure that ownership benefits of the developed software products are realised (Knaster and Leffingwell, 2018). Above all, it is also of paramount importance to ensure that objective evidence is required to prove that the developed software products conform to those standards. Inspect and adapt is the process implemented to reflect, collect data and solve problems if found in a continuous cycle (Neve et al., 2017). Inspect and adapt is also responsible to define actions to be implemented to ensure velocity, reliability and quality of the upcoming PIs (Knaster and Leffingwell, 2018). Stakeholder engagement is important because it directly affects the internal organisation's performance and external stakeholder value.

2.1.3 Team level

Agile teams are the foundation of scaling agile because they perform most of the implementation effort. In fact, all software development activities take place at the team level. The team *defines*, *build*, *test* and *deploy user stories* from a backlog in a sequence of iterations using common iteration cadences to align the activities with other teams working on other parts of the whole software project (Uludağ et al., 2017).

These four main processes are implemented at the team level to determine quality deliverable as agreed with the customer. Agile teams are responsible for delivering software projects that meet customer requirements and specifications. Customers are more likely to be satisfied when specifications are met, and the final product is used to solve the problem at hand. These software projects must have built-in quality to ensure that every element of the solution reflects quality standards. Teams involve the roles, activities, and processes that agile development teams use to build and deliver work products. All software development teams belong to a single ART which is responsible to deliver continuous quality release value to the customers (Uludağ et al., 2017, Razzak et al., 2018). The software development teams are coordinated and integrated via collective iterations that provide valuable increment of new functionality. Each iteration results in a system demo for ART integration (Razzak et al., 2018).

2.2 Theoretical conceptual framework for scaled agile success

Gregor (2006) discusses five types of information system theories that can be used in research. These theories include:

1 theory for analysis

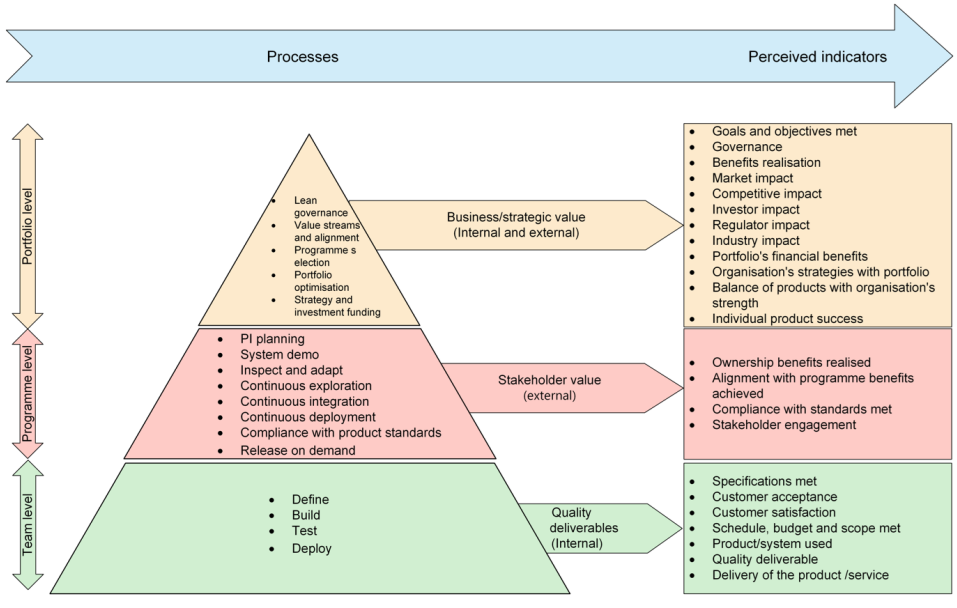
2 theory for explanation

3 theory for prediction

4 theory for explanation and prediction and lastly

5 theory for design and action.

Figure 1 Theoretical conceptual framework for scaled agile success (see online version for colours)



Source: Bannerman and Thorogood (2012), Stettina and Hörz (2015), Knaster and Leffingwell (2018), Scaled agile Inc. (2018) and Walenta (2016)

Since the objective of this current study is to develop a conceptual framework for scaled agile success after determining the processes currently implemented to achieve the perceived indicators, a theory of explanation and prediction is used. The theoretical conceptual framework for scaled agile success was developed based on the literature review (Bannerman, 2008; Knaster and Leffingwell, 2018; Scaled Agile Inc., 2018) and falls within the explanation and prediction theory that provides testable propositions (Gregor, 2006). In any scaling framework used in an organisation, there are three main levels (the team, the program and the portfolio) that should work together towards delivering a working software project. The team level is where products are initiated, the program level where products are combined for benefits realisation and lastly the portfolio level where the strategic objectives of the organisation are achieved (Paasivaara et al., 2018). This conceptual framework shows different perceived indicators of success at each level without any indication on whether they are achieved by performing the given processes. The perceived indicators of success show that organisations have high expectations towards the success of their software projects. Figure 1 depicts the conceptual framework for scaled agile success. This conceptual framework which includes both processes and the perceived indicators has been theoretically created from the literature review, hence it needs to be tested and validated for its relevance on how it can be applied in practice.

3 Research methodology

An online survey was used to collect the quantitative data through a structured questionnaire. The questionnaire for this study was theoretically designed based on the literature review focusing on scaled agile success. A total number of 347 responses were collected and expert sampling was adopted since the objective was to get views and insights from experts in the field of scaled agile. However, only 217 (62.5%) were fully completed. The remaining 130 (37.5%) were partially completed and not used as part of the data analysis. A structured questionnaire with close-ended questions was used as the data collection instrument. The questionnaire options were designed to include some Likert-scale questions ranging from extremely satisfied to not at all satisfied as seen in Appendix 2. The population of interest for this research study consisted of IT professionals from software developing organisations pursuing software projects more especially those with experience in scaled agile such as product owners, scrum owners, program managers and product managers. The majority (34%) of the respondents fulfilled the role of a scrum master. The specialists such as the epic owners, portfolio managers, program managers, business owners, value stream owners and enterprise architects amounted to 17%. The specialists informed the knowledge on the processes and the perceived indicators at the portfolio and the program level. With regards to agile work experience, 62.2% has between one and seven years' experience with 7.4% claiming they have more than 20 years' experience in agile.

To analyse the data and to construct the final conceptual framework, Pearson's correlation and MLR are used. Pearson's correlations are used to identify any significant correlations between the processes and the perceived indicators at the portfolio, program and the team levels. Validity measures the accuracy of the data collection instruments to ensure that it measures what it purposes to measure (Blumberg et al., 2008, Zikmund et al., 2010). The questionnaire was tested to ensure that all the findings from the research study address the research goal of developing a conceptual framework for scaled agile success. Construct validity was used in this research. Construct validity measures the degree to which the research tools measure the envisioned construct (Blumberg et al., 2008, Zikmund et al., 2010). Internal, external and content validity were used in this research study in order to aid construct validity. Cronbach's alpha is used to measure the reliability and the internal consistency of a set of related items or defined variables (Field, 2018). The Cronbach's alpha result for 41 items is 0.972 indicating that there was good internal consistency and good reliability.

4 Data analysis

A weighted average score is the average of data set that recognises the importance of certain numbers above others (L'Hermite et al., 2009). A weighted average score is used to rank and prioritise features as it helps in making sound and efficient decisions. Weighted average scores helps to determine and evaluate trends among features (L'Hermite et al., 2009). The weighted average scores were calculated as follows:

Step 1 The percentage of responses in each category was multiplied by the total number of participants.

Step 2 The results of step 1 were multiplied by the value of each category (not at all satisfied: 1, slightly satisfied: 2, moderately satisfied: 3, very satisfied: 4, extremely satisfied: 5).

Step 3 The sum of the different elements in each category was calculated.

Table 1 Weighted average scores for processes at the portfolio, program and team level (see online version for colours)

Processes (portfolio level)	*Weighted average score*
Program selection	732
Value stream and alignment	719
Portfolio optmisation	715
Strategy and investment funding	713
Lean governance	698
Processes (program level)	*Weighted average score*
System demo	821
Inspect and adapt	814
Continuous integration	777
Continuous exploration	768
Continuous deployment	768
PI Planning	759
Compliance	751
Release on demand	728
Processes (team level)	*Weighted average scores*
Delivery of products and services	837
Build	825
Deploy	820
Test	806
Define	794

Notes: The colours indicate scores for each process. The higher scores indicate the most satisfactory processes.

At the portfolio level, *program selection* at the top of the list. This is followed by *value stream and alignment*. The portfolio level is responsible to select programs that will provide the highest financial value to the organisation. At a strategic level, metrics are needed for the allocation of funds in different value streams and ART. The results confirm that at the portfolio level, the focus is to ensure that processes are eliminated and the goal which is the value with positive impact to the customer is maintained (Alhammadi and Shaalan, 2018; Kersten, 2018; Knaster and Leffingwell, 2018). System demo is the most important process implemented at the program level. Though other studies do not mention the level of importance of the processes implemented at the program level, it is good practice that the product being developed is being demonstrated to the customer from the early stages to avoid problems found during user acceptance testing (UAT) (Padmini et al., 2016). It is evident from the results the delivery of products and services is ranked the top process at the team level. These results are

confirmed by studies by Beecham et al. (2014) stating that the team should be involved in ensuring that the final quality product is deployed and delivered to the customer successfully. Table 1 shows the weighted average scores for the processes implemented at the portfolio, program and team levels.

Table 2 Weighted average scores for the indicators of success at the portfolio level (see online version for colours)

Perceived indicators (portfolio level)	*Weighted average scores*
The success of individual products	806
Goals and objectives met	782
Industry impact	765
Market impact	763
Balance of the products	763
Competitive impact	755
Regulator impact	753
Strategies with the portfolio	747
Investor impact	743
Benefits realisation	742
Governance	736
Financial benefits	726
Perceived indicators (program level)	*Weighted average scores*
Stakeholder engagement	807
Alignment with program benefits achieved	795
Ownership benefits realised	790
Compliance with standards met	773
Perceived indicators (team)	*Weighted average score*
Customer acceptance	853
Customer satisfaction	850
Quality deliverable	847
Delivery of the product/service	846
Specifications met	829
Product/system used	815
Schedule, budget and scope met	730

Notes: The colours indicate scores for each perceived indicator. The higher scores indicate the most satisfactory perceived indicators.

The results in Table 2 indicate that the success of an individual product, goals and objectives met, industry impact, market impact and lastly the balance of the products with the organisation's benefits are the top five indicators of success at the portfolio level. These should be the indicators that organisations should be aiming to achieve (Bannerman, 2008) in order to maximise the financial value of the organisation (Heising, 2012; Stettina and Hörz, 2015). In short, the results show that the success of the portfolio level is informed by the success of the team level or the lower levels where individual

products are implemented. Though software developing organisations are strategically driven at the portfolio level, the lower teams such as the program and the team levels play a major role in the success of the portfolio level and to ensure that all perceived indicators are achieved. Stakeholder engagement is the top indicator of success at the program level. This is in alignment with other studies stating that programs are measured successfully based on the strategy alignment, governance and stakeholder engagement (Stettina and Hörz, 2015; Walenta, 2016). Though previous studies do not state which indicator is the most important measure of success, this study has therefore closed that gap as it is evident that stakeholder engagement is of utmost importance. For customers to be satisfied, it is necessary for all stakeholders of a specific project to be involved throughout the project life cycle. When customers are not involved, failure is inevitable (Dikert et al., 2016). To add on these confirmation is the emphasis of agile values and principles as they focus more on continuous interactions and collaborations of project team members and the customers in order to deliver projects successfully (Marnewick and van Wyk, 2018). When customers are satisfied, they are likely to accept the final product. Customer acceptance is ranked top and not far from that is customer satisfaction. The results are not surprising since most studies concur that customer satisfaction should remain the top priority when developing a software product. The agile Manifesto also concurs with these findings as it states that the highest priority is to satisfy customers through early and continuous delivery of valuable software (Marnewick and van Wyk, 2018). Table 2 shows the weighted scores for the indicators of success at the portfolio, program and team level.

4.1 Pearson correlations

Pearson correlation analysis is performed to determine whether there are any significant relationships between the processes and the perceived indicators. To determine the significance of the results, an r value is used. That is r values below 0.300 indicate small or weak relationships, r values from 0.300 to 0.499 indicate medium or moderate relationships, and r values from 0.500 to 1.000 indicate large or strong relationship (Field, 2018). Details about the correlations performed can be seen in Appendix 1.

4.1.1 Portfolio level

There are no small or weak relationships between the processes and the perceived indicators at the portfolio level. There are only moderate and strong relationships between the processes and the perceived indicators at the portfolio level. When organisations focus on strategy and investment funding, they are likely to achieve 11 out of the 12 (91.7%) perceived indicators with significant strong relationships. These results are not a surprise since the main goal of the portfolio level should be to maximise the financial value of the enterprise (Stettina and Hörz, 2015; Knaster and Leffingwell, 2018; Heising, 2012). The portfolio level is also responsible to secure enough funding to be distributed in different products. Hence, all projects must be aligned with the vision of the enterprise (Knaster and Leffingwell, 2018; Alqudah and Razali, 2016). When organisations perform their portfolio optimisation, they are likely to achieve 6 out of the 12 (50%) perceived indicators with strong relationships at the portfolio level. Lastly, the program selection will only yield 2 out of the 12 (16.7%) perceived indicators with strong

relationships at the portfolio level. This concludes that the main focus of the portfolio level should be on strategy and investment funding.

4.1.2 Program level

There is only one significant strong relationship between system demo and alignment with program benefits achieved (r = 0.520 and p-value = 0.000). It is noted that most of the processes have moderate relationships with the perceived indicators. Since the success of this level is measured based on stakeholder engagement, compliance, ownership and alignment (Stettina and Hörz, 2015; Walenta, 2016), one would expect these perceived indicators to have strong significant relationships. The results are contradicting literature more especially with stakeholder engagement since it has weak significant relationships which are ranked as slightly important. It will be difficult to achieve stakeholder value since the stakeholders are not engaged as per the results.

4.1.3 Team level

Moderate and strong significant relationships are observed at this level. With define, it is observed that the perceived indicators have moderate significant relationships. With Build, only one strong significant relationship is observed, and this is with quality deliverable. Test and deploy have 3 out of the 7 (42.8%) perceived indicators with strong significant relationships. The team level should focus on defining the requirements, building, deploying and testing the final system that will be delivered to the customers (Stettina and Hörz, 2015; Walenta, 2016). The perceived indicators achieved are quality deliverable, customer acceptance, customer satisfaction, delivery of the product/service. These deliverables should be the highest priority to the customer with customer satisfaction being the primary measure of success.

4.2 MLR

Before MLR analysis can be performed, certain assumptions must be tested to increase the validity of the results since they cannot be trusted if assumptions are violated. These assumptions include multicollinearity, heteroscedasticity, autocorrelation and multivariate normal distributions. All assumptions were accepted except multivariate normal distributions which has outliers. The most common method used to eliminate outliers are trimming and winsorising (Field, 2018). The winsorising method was used since no extreme quantities of scores were observed within the Mahalanobis distances. At the portfolio level, two cases were outliers. Case 215 is the highest case that is not an outlier and has a value of 17.42883. Case 216 is the first case that is an outlier and has a value of 24.19153. Adding a 1 from case 215 value (whole number: 17) gives the next highest value for case 216 (18.19153) that is not an outlier. After the winsorising process, the Mahalanobis distance for the portfolio level is 19.765 and the Mahalanobis distance for the program level is 30.837. Therefore, all outliers have been eliminated (refer to Appendix 3 for the Mahalanobis distances).

Since all assumptions were tested and validated, it is viable to continue with MLR analysis. MLR is used to assess how much the independent variables predict the dependent variables. It is important to understand which of the variables included in the model contribute to the prediction of the dependent variable and to determine this the

coefficients table is used (Field, 2018). To identify the contribution of each independent variable, it is vital to consider the largest beta value ignoring negative signs (refer to Appendix 4 for the R-squared and adjusted R-squared model summary). The Sig. value in each of the variables dictate how much statistical significance each variable is contributing to the calculation. Sig. values below 0.05 indicate a significant unique contribution to the prediction of the dependent variable. Sig. values above 0.05 indicate that no significant unique contribution to the prediction of the dependent variable.

Table 3 Portfolio level coefficients (see online version for colours)

Sig.		*Processes*				
Not sig.		*Lean governance*	*Value stream and alignment*	*Program selection*	*Portfolio optimisation*	*Strategy and investment funding*
	Model	*Beta | Sig.*	*Beta | Sig.*	*Beta | Sig.*	*Beta | Sig.*	*Beta | Sig.*
Perceived indicators	1 (Goals and objectives met)	0.002 | 0.980	0.246 | 0.007	0.107 | 0.231	0.151 | 0.082	0.207 | 0.009
	2 (Governance)	0.179 | 0.042	0.174 | 0.056	–0.092 | 0.305	0.235 | 0.007	0.207 | 0.009
	3 (Benefits reliasation)	0.124 | 0.156	–0.048 | 0.592	0.079 | 0.378	0.201 | 0.020	0.349 | 0
	4 (Market impact)	0.171 | 0.061	0.010 | 0.912	0.095 | 0.305	0.037 | 0.683	0.344 | 0
	5 (Industry impact)	0.143 | 0.121	0.034 | 0.717	0.081 | 0.390	0.055 | 0.546	0.331 | 0
	6 (Competitive impact)	0.159 | 0.073	0.052 | 0.570	0.089 | 0.324	0.144 | 0.100	0.259 | 0.001
	7 (Investor impact)	0.100 | 0.241	0.082 | 0.351	0.086 | 0.324	0.157 | 0.062	0.320 | 0
	8 (Regulator impact)	0.249 | 0.011	0.013 | 0.900	0.033 | 0.738	0.098 | 0.305	0.167 | 0.058
	9 (Portfolio's financial benefits)	0.133 | 0.136	0.110 | 0.232	0.004 | 0.967	0.239 | 0.007	0.209 | 0.010
	10 (Organisation's strategies with portfolio)	0.093 | 0.306	0.165 | 0.079	0.035 | 0.707	0.146 | 0.105	0.228 | 0.006
	11 (Balance of the products with organisations' strength)	0.153 | 0.093	0.124 | 0.186	–0.045 | 0.627	0.076 | 0.397	0.341 | 0
	12 (Individual products success)	0.060 | 0.504	0.158 | 0.089	0.028 | 0.760	0.061 | 0.490	0.368 | 0

4.2.1 Portfolio level: evaluating each of the independent variables

Table 3 illustrates the contributions of each independent variable. In this case, the largest beta value for model 1 is 0.246, which is for value stream and alignment. This means that among the five independent variables, value stream and alignment makes the strongest unique contribution in explaining the dependent variable (goals and objectives met), when the variability explained by all other variables in the model is controlled for. Out of the twelve dependent variables, eleven of them are statistically significant with the independent variable strategy and investment funding. Overall, strategy and investment funding contributes the highest beta value (0.368) to the prediction of the models at the entire portfolio level and this is in alignment with the correlations statistics performed earlier. This means that strategy and investment funding makes the strongest unique contribution in explaining all the dependent variables. This would mean that the focus at the portfolio level should be on strategy and investment funding. The green blocks indicate significant processes and perceived indicators while the red indicated the processes and perceived indicators that are insignificant.

The results depicted in Table 3 attest to the fact that the portfolio level should strive to maximise the financial value of the enterprise (Heising, 2012; Knaster and Leffingwell, 2018; Stettina and Hörz, 2015). Enough funding should be secured at this level and allocated to different products. Therefore, it is of utmost importance for each product to be aligned with the vision of the enterprise (Alqudah and Razali, 2016; Knaster and Leffingwell, 2018). Though part of the processes performed at the portfolio level include program selection, the results show that program selection does not contribute towards the prediction of the models at the portfolio level. Therefore, it will be deleted in the final constructed model. Strategy and investment funding contributes the highest in the prediction of the models and the only perceived indicator that cannot be achieved with this process is the regulator impact which is achieved through lean governance. Therefore, to streamline the processes and to focus on the value of those processes (Bhavsar et al., 2020), it will therefore mean that at the portfolio level, organisations can opt to only focus on strategy and investment funding and lean governance.

4.2.2 Program level: evaluating each of the independent variables

Table 4 illustrates the contributions of each independent variable to the dependent variable at the program level. The largest beta value for model 1 is 0.212, which is for continuous exploration. This means that continuous exploration makes the strongest unique contribution in explaining the dependent variable (ownership benefits realised), when the variability explained by all other variables in the model is controlled for. When evaluating the entire program level, the largest beta value is for system demo in model 2 (alignment with program benefits achieved) with a value of 0.316. This mean that system demo contributes the highest in predicting the models at the program level. The results also reveal that there is no unique statistical contribution made by continuous integration and continuous deployment and therefore they will be deleted in the final constructed model.

The Pearson's correlations have highlighted that it is only the system demo process that has a strong significant relationship with the perceived indicators. Hence, system demo shows the highest beta value with alignment with program benefits achieved. The

other processes yielded either medium or weak significant relationships. Continuous integration and continuous deployment are some of the core processes at the program level (Knaster and Leffingwell, 2018). However, the results of this study show that these two processes are not statistically significant in predicting the outcome at this level and is not in alignment with the current literature. To be successful at the program level, stakeholder engagement, compliance, ownership and alignment are key (Knaster and Leffingwell, 2018; Stettina and Hörz, 2015; Walenta, 2016).

Table 4 Program level coefficients (see online version for colours)

Sig.		*Processes*			
Not sig.		*PI planning*	*System demo*	*Inspect and adapt*	*Continuous exploration*
	Model	*Beta | Sig.*	*Beta | Sig.*	*Beta | Sig.*	*Beta | Sig.*
Perceived indicators	1 (Ownership benefits realised)	0.048 | 0.522	0.180 | 0.095	–0.080 | 0.469	0.212 | 0.035
	2 (Alignment with program benefits achieved)	0.108 | 0.138	0.316 | 0.003	–0.109 | 0.311	0.070 | 0.474
	3 (Compliance with standards met)	0.245 | 0.002	0.031 | 0.779	–0.115 | 0.314	0.167 | 0.107
	4 (Stakeholder engagement)	0.137 | 0.084	0.196 | 0.087	–0.228 | 0.054	0.206 | 0.055
Sig.		*Processes*			
Not sig.		*Continuous integration*	*Continuous deployment*	*Compliance with product management standards*	*Release on demand*
	Model	*Beta | Sig.*	*Beta | Sig.*	*Beta | Sig.*	*Beta | Sig.*
Perceived indicators	1 (Ownership benefits realised)	0.129 | 0.249	–0.047 | 0.698	0.131 | 0.110	0.080 | 0.407
	2 (Alignment with program benefits achieved)	0.142 | 0.191	0.016 | 0.893	0.117 | 0.144	0.031 | 0.738
	3 (Compliance with standards met)	0.015 | 0.898	0.074 | 0.550	0.184 | 0.029	0.020 | 0.838
	4 (Stakeholder engagement)	–0.124 | 0.297	–0.053 | 0.680	0.042 | 0.628	0.315 | 0.002

4.2.3 Team level: evaluating each of the independent variables

Table 5 illustrates the contributions of each independent variable to the prediction of the dependent variables. In this case, the largest beta value is 0.325, which is contributed by the independent variable test for model 6. This means that test makes the strongest unique contribution in explaining the dependent variable (quality deliverable), when the variability explained by all other variables in the model is controlled for. Define does not statistically contribute to the prediction of the models at the team level.

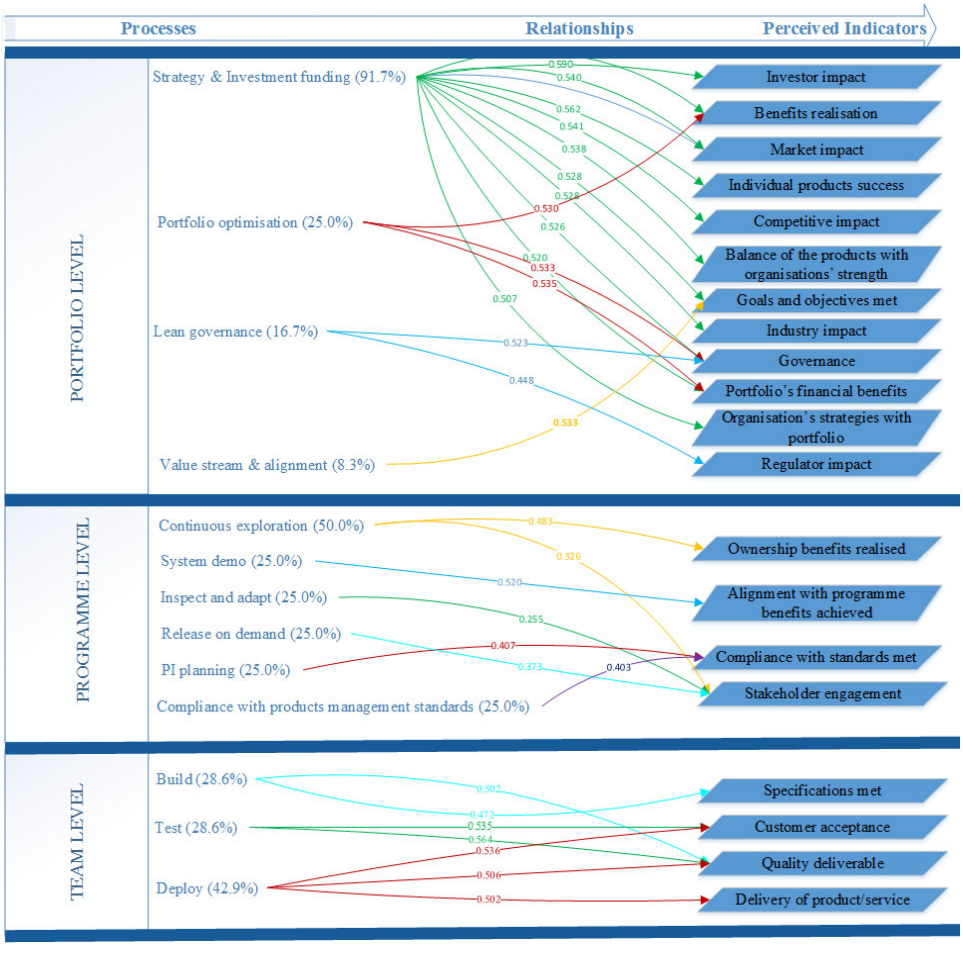
Literature has revealed that the quality of the deliverable should not be compromised (Papadakis and Tsironis, 2018; Alhammadi and Shaalan, 2018). None of the four processes at the team level have statistically significant relationships with customer satisfaction, schedule, budget and scope met and product/system used. These results could be the answer on why some software projects are not successful since not much is done to achieve the expected outcomes. The results also reveal that there is no unique statistical contribution made by define and therefore it will be deleted in the final constructed model. Knaster and Leffingwell (2018) argue that customer satisfaction should be the primary measure of product success. However, the results of this current study are not supported by literature and it raises some concerns for further investigations. It is of paramount importance for the developed conceptual framework to be tested for its relevance based on the collected data. Pearson's correlations and MLR were used to identify if there were any significant correlations between the processes and the perceived indicators at portfolio, program and team level. This process enabled the construction of the final conceptual framework. Where there was no correlation between the processes and the perceived indicators, such indicators were flagged. Further analysis was done using MLR in which processes were deleted where there was no correlation. The reason for this is that if there is no correlation, it means that by performing these specific processes, there is no guarantee of achieving the perceived indicators. The results of the correlations were then linked with the results from MLR. The linking ensured the alignment of the results, and the expectation was for both correlations and MLR results to be similar.

The results of the Pearson's correlations and MLR have therefore revealed the final conceptual framework for scaled agile success as shown in Figure 2.

Table 5 Team level coefficients (see online version for colours)

Sig.		*Processes*			
Not Sig.		*Define*	*Build*	*Test*	*Deploy*
	Model	*Beta | Sig.*	*Beta | Sig.*	*Beta | Sig.*	*Beta | Sig.*
Perceived indicators	1 (Specifications met)	0.144 | 0.097	0.183 | 0.031	0.031 | 0.698	0.062 | .453
	2 (Customer acceptance)	0.053 | 0.599	0.130 | 0.189	0.224 | 0.019	0.276 | 0.005
	3 (Customer satisfaction)	0.086 | 0.385	0.073 | 0.448	0.056 | 0.543	–0.005 | 0.956
	4 (Schedule, budget and scope met)	0.102 | 0.194	0.036 | 0.636	0.088 | 0.228	–0.001 | 0.992
	5 (Product/system used)	0.044 | 0.610	–0.106 | 0.208	–0.038 | 0.639	–0.025 | 0.765
	6 (Quality deliverable)	0.147 | 0.128	0.254 | 0.007	0.325 | 0	0.192 | 0.038
	7 (Delivery of the product/service)	0.083 | 0.359	0.085 | 0.335	0.021 | 0.799	0.176 | 0.042

Figure 2 Final conceptual framework for scaled agile success (see online version for colours)



5 Discussion

The theoretical conceptual framework for scaled agile success has shown that there are five processes that are implemented to achieve the perceived indicators at the portfolio level. The research findings using MLR have shown that among these five processes, program selection does not show any statistically significant contribution towards the achievement of any of the perceived indicators. This means that some of the processes that organisations are currently implementing at the portfolio level do not lead to success or do not contribute to the achievement of the perceived indicators. At the portfolio level, the following are the propositions:

Proposition 1 Organisations should put more focus on strategy and investment since it contributes 91.7% in achieving the perceived indicators. The focus on strategy and investment funding will ensure success at the portfolio level. Since this is the highest level of decision making and financial accountability, the results indicate that processes are streamlined to give the best solutions and the achievement of all the perceived indicators.

Proposition 2 Organisations should implement value streams and alignment and this will assist in making sure that they select and implement the right products aligned with the strategic objective of the organisation. Value streams and alignment will ensure that only investments in the right products are made for the portfolio to achieve its strategic and business objective of maximising return on investment (ROI). The results have indicated that goals and objectives to balance the implementation of change initiatives will be achieved through value streams and alignments.

The theoretical conceptual framework has shown that there are eight processes that are implemented to achieve the perceived indicators at the program level. The research findings have shown that continuous integration and continuous deployment do not have any significant contribution towards the achievement of the perceived indicators. Since some processes were not statistically significant in achieving the perceived indicators, it is therefore an indication that organisations are currently implementing some of the processes at the program level that do not lead to success or do not contribute to the achieving of the perceived indicators. All the perceived indicators were successfully achieved without implementing continuous integration and continuous deployment. At the program level, the following are the propositions:

Proposition 3 Organisations should focus on continuous exploration to achieve stakeholder engagement and ownership benefits realised. This will ensure that continuous releases of solutions will be delivered to the customer. The results have revealed that the focus of the program level is stakeholder value where solutions are delivered through the ART.

Proposition 4 Organisations must ensure that there is sufficient collaboration between the development team and the stakeholders and that they have a common vision that can be discussed during PI planning sessions. Results have shown that the implementation of PI planning ensures that compliance with standards are met. Therefore, different teams within the same ART will have a common understanding of the solutions that needs to be delivered to customers and this will be done in a standard format as agreed by different teams during PI planning sessions.

Proposition 5 The implementation of release on demand will ensure that the stakeholders are engaged and value will be achieved. The contribution of stakeholder value at this level is of great importance to the organisation to maximise the value of the flow to the stakeholders. Therefore, organisations must make sure that they respond to customers' demand by continuously deploying new functionalities into production for the benefit of the customers. Part of meeting the customers' demand, organisations should demo their solutions to show progress to the customer.

The theoretical conceptual framework has shown that there are four processes that are implemented to achieve the perceived indicators at the team level. The research findings have shown that define does not have any significant contribution towards the achievement of the perceived indicators. At the team level, the following is proposed:

Proposition 6 Organisations should ensure that they build high performing teams that will ensure success at the program level with a focus on building quality deliverables. This is because the success of individual products implemented at the team level plays a major role of success at the portfolio level. The team level is the foundation for a Lean enterprise and the goal of the team level is for the team to deliver quality deliverables.

The MLR results have revealed two important key aspects to be noted. Firstly, it has been noted that the independent variables when taken as a set, are statistically significant across all the three levels, viz., the portfolio, the program and the team level. It was noted that the independent variables contribute differently to the prediction of the dependent variables. At the same time the results revealed that not all independent variables contributed to the prediction of the dependent variables and these were deleted. At the portfolio and at the program level, all the dependent variables were predicted by either one or more independent variables. However, the team level has shown that customer satisfaction, schedule, budget and scope met and product/system used were not predicted by any independent variables. This is therefore opening opportunities for further investigations to determine which processes are missing at the team level to achieve all the dependent variables.

6 Conclusions

This article was aimed at introducing a conceptual framework for scaled agile success. Different processes and perceived indicators at each level were discussed. The objective was to determine the perceived indicators achieved by organisations at each level by implementing the given processes.

Currently there are processes that are implemented but these implemented processes do not lead to achieving the perceived indicators of success as intended. This has therefore some implications on the financial state of the organisation since lots of money are spent on processes that do not help them to achieve any success or return on investment.

This research contributes by identifying the processes that should be implemented at portfolio, program and the team levels. With a clear understanding of these processes, a solid foundation in scaled agile success has been built. Part of the understanding of the processes, this article contributed with regards to the strengths of the contributions of each process towards the success of software projects. Secondly, the understanding of the perceived indicators that should be used to measure the success of scaled agile contributes to the current knowledge. Previous literature has not tried to indicate the relationship between the processes and the perceived indicators at the portfolio, program and the team levels within a scaled agile environment. The relationships were tested and validated and they add value to the current body of knowledge. This is a new contribution to current literature, specifically to the literature focusing on scaled agile. The proposed conceptual framework is expected to serve as a guiding instrument to all the stakeholders

that are involved in scaled agile to manage and understand what needs to be done at each level to achieve the expected results.

A conceptual framework was developed and it will open new avenues for future research. Future research could focus on cross relationships between the three levels. For example, to understand if there are any perceived indicators that can be achieved at the portfolio level by implementing processes at the program level. The team level revealed some perceived indicators that were not achieved by implementing the given processes, future research study could focus on finding other processes that needs to be implemented in order to achieve all the perceived indicators. Perspectives of the balanced scorecard or another tool for executing and tracking the strategy should be examined in future to see if there is anything about scaled agile. Pearson's correlation has been used, perhaps future research studies can focus on Spearman's correlation for verification and analysis.

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Appendix 1

Pearson's correlations

Table A1 Correlations between processes and the perceived indicators at the portfolio level (see online version for colours)

Key: correlations — *Strong* (green), *Moderate* (yellow), *Weak* (red)

Perceived indicators		*Processes*: *Lean governance*	*Value stream and alignment*	*Program selection*	*Portfolio optmisation*	*Strategy and investment funding*
Goals and objectives met	Pearson correlation	0.481**	0.553**	0.516**	0.525**	0.528**
	Sig. (2-tailed)	0	0	0	0	0
	N	217	217	217	217	217
Governance	Pearson correlation	0.523**	0.526**	0.447**	0.533**	0.526**
	Sig. (2-tailed)	0	0	0	0	0
	N	217	217	217	217	217
Benefits realisation	Pearson correlation	0.490**	0.451**	0.487**	0.530**	0.575**
	Sig. (2-tailed)	0	0	0	0	0
	N	217	217	217	217	217
Market impact	Pearson correlation	0.483**	0.443**	0.456**	0.443**	0.540**
	Sig. (2-tailed)	0	0	0	0	0
	N	217	217	217	217	217
Industry impact	Pearson correlation	0.466**	0.440**	0.444**	0.440**	0.528**
	Sig. (2-tailed)	0	0	0	0	0
	N	217	217	217	217	217
Competitive impact	Pearson correlation	0.513**	0.490**	0.496**	0.511**	0.541**
	Sig. (2-tailed)	0	0	0	0	0
	N	217	217	217	217	217

Note: ** Correlation is significant at the 0.01 level (2-tailed).

Table A1 Correlations between processes and the perceived indicators at the portfolio level (continued) (see online version for colours)

Key: correlations (Strong / Moderate / Weak)			*Processes*				
			Lean governance	*Value stream and alignment*	*Program selection*	*Portfolio optmisation*	*Strategy and investment funding*
Perceived indicators	Investor impact	Pearson correlation	0.520**	0.521**	0.520**	0.544**	0.590**
		Sig. (2-tailed)	0	0	0	0	0
		N	217	217	217	217	217
	Regulator impact	Pearson correlation	0.448**	0.388**	0.384**	0.397**	0.416**
		Sig. (2-tailed)	0	0	0	0	0
		N	217	217	217	217	217
	Making the best of the portfolio's financial benefits	Pearson correlation	0.500**	0.500**	0.471**	0.535**	0.520**
		Sig. (2-tailed)	0	0	0	0	0
		N	217	217	217	217	217
	The relationship between the organisation's strategies with the portfolio	Pearson correlation	0.474**	0.498**	0.459**	0.487**	0.507**
		Sig. (2-tailed)	0	0	0	0	0
		N	217	217	217	217	217
	Balance of the products with organisations' strength	Pearson correlation	0.476**	0.470**	0.410**	0.445**	0.538**
		Sig. (2-tailed)	0	0	0	0	0
		N	217	217	217	217	217
	The success of individual products	Pearson correlation	0.464**	0.494**	0.449**	0.462**	0.562**
		Sig. (2-tailed)	0	0	0	0	0
		N	217	217	217	217	217

Note: ** Correlation is significant at the 0.01 level (2-tailed).

Table A2 Correlations between processes and the perceived indicators at the program level (see online version for colours)

Strong / *Moderate* / *Weak*			*Perceived indicators*			
Key: correlations			*Ownership benefits realised*	*Alignment with program benefits achieved*	*Compliance with standards met*	*Stakeholder engagement*
Processes	PI Planning	Pearson correlation	0.341**	0.407**	0.407**	0.299**
		Sig. (2-tailed)	0	0	0	0
		N	217	217	217	217
	System demo	Pearson correlation	0.460**	0.520**	0.363**	0.322**
		Sig. (2-tailed)	0	0	0	0
		N	217	217	217	217
	Inspect and adapt	Pearson correlation	0.422**	0.436**	0.330**	0.255**
		Sig. (2-tailed)	0	0	0	0
		N	217	217	217	217
	Continuous exploration	Pearson correlation	0.483**	0.457**	0.392**	0.326**
		Sig. (2-tailed)	0	0	0	0
		N	217	217	217	217
	Continuous integration	Pearson correlation	0.444**	0.466**	0.360**	0.228**
		Sig. (2-tailed)	0	0	0	00.001
		N	217	217	217	217
	Continuous deployment	Pearson correlation	0.410**	0.436**	0.372**	0.277**
		Sig. (2-tailed)	0	0	0	0
		N	217	217	217	217
	Compliance with product management standards	Pearson correlation	0.413**	0.414**	0 0.403**	0.296**
		Sig. (2-tailed)	0	0	0	0
		N	217	217	217	217
	Release on demand	Pearson correlation	0.395**	0.389**	0.345**	0.373**
		Sig. (2-tailed)	0	0	0	0
		N	217	217	217	217

Note: ** Correlation is significant at the0.01 level (2-tailed).

Table A3 Correlations between processes and the perceived indicators at the team level (see online version for colours)

Key: correlations		*Perceived indicators*						
Strong (green) / Moderate (yellow) / Weak (red)		*Specifications met*	*Customer acceptance*	*Customer satisfaction*	*Schedule, budget and scope met*	*Product/system used*	*Quality deliverable*	*Delivery of the product/service*
Processes: Define	Pearson correlation	0.444**	0.446**	0.451**	0.405**	0.412**	0.465**	0.436**
	Sig. (2-tailed)	0	0	0	0	0	0	0
	N	217	217	217	217	217	217	217
Build	Pearson correlation	0.472**	0.485**	0.471**	0.368**	0.353**	0.502**	0.446**
	Sig. (2-tailed)	0	0	0	0	0	0	0
	N	217	217	217	217	217	217	217
Test	Pearson correlation	0.444**	0.535**	0.510**	0.428**	0.419**	0.564**	0.463**
	Sig. (2-tailed)	0	0	0	0	0	0	0
	N	217	217	217	217	217	217	217
Deploy	Pearson correlation	0.448**	0.536**	0.468**	0.366**	0.404**	0.506**	0.502**
	Sig. (2-tailed)	0	0	0	0	0	0	0
	N	217	217	217	217	217	217	217

Note: ** Correlation is significant at the 0.01 level (2-tailed).

Appendix 2

Questionnaire (abstract from the full questionnaire)

Project title: A conceptual framework for scaled agile success

Table A4 Measuring the satisfaction of processes implemented in the portfolio, program and the team levels

While adopting scaled agile, how satisfied were you in implementing the following processes?						
8	*Portfolio level*	*1*	*2*	*3*	*4*	*5*
		Not at all satisfied	*Slightly satisfied*	*Moderately satisfied*	*Very satisfied*	*Extremely satisfied*
8.1	Lean governance					
8.2	Value stream and alignment					
8.3	Program selection					
8.4	Portfolio optimisation					
8.5	Strategy and investment funding					
9	*Program level*	*1*	*2*	*3*	*4*	*5*
		Not at all satisfied	*Slightly satisfied*	*Moderately satisfied*	*Very satisfied*	*Extremely satisfied*
9.1	PI planning					
9.2	System demo					
9.3	Inspect and adapt					
	Continuous exploration					
9.4	Continuous integration					
9.5	Continuous deployment					
9.6	Compliance with product management standards					
9.7	Release on demand					
10	*Products*	*1*	*2*	*3*	*4*	*5*
		Not at all satisfied	*Slightly satisfied*	*Moderately satisfied*	*Very satisfied*	*Extremely satisfied*
10.1	Delivery of products and services					
10.2	Define					
10.3	Build					
10.4	Test					
10.5	Deploy					

Table A5 Measuring the satisfaction of achieving the following indicators of scaled agile in the portfolio, program and the team levels

While adopting scaled agile, how satisfied were you in achieving the following?						
		1	*2*	*3*	*4*	*5*
11	*Portfolio level*	*Not at all satisfied*	*Slightly satisfied*	*Moderately satisfied*	*Very satisfied*	*Extremely satisfied*
11.1	Goals and objectives met					
11.2	Governance					
11.3	Benefits realisation					
11.4	Market impact					
11.5	Industry impact					
11.6	Competitive impact					
11.7	Investor impact					
11.8	Regulator impact					
11.9	Making the best of the portfolio's financial benefits					
11.10	The relationship between the organisation's strategies with the portfolio					
11.11	Balance of the products with organisations' strength					
11.12	The success of individual products					
		1	*2*	*3*	*4*	*5*
11	*Portfolio level*	*Not at all satisfied*	*Slightly satisfied*	*Moderately satisfied*	*Very satisfied*	*Extremely satisfied*
12.1	Ownership benefits realised					
12.2	Alignment with program benefits achieved					
12.3	Compliance with standards met					
	Strategy alignment					
12.4	Stakeholder engagement					

Table A5 measuring the satisfaction of achieving the following indicators of scaled agile in the portfolio, program and the team levels (continued)

While adopting scaled agile, how satisfied were you in achieving the following?						
		1	*2*	*3*	*4*	*5*
11	*Portfolio level*	*Not at all satisfied*	*Slightly satisfied*	*Moderately satisfied*	*Very satisfied*	*Extremely satisfied*
13.1	Specifications met					
13.2	Customer acceptance					
13.3	Customer satisfaction					
13.4	Schedule, budget and scope met					
13.5	Product/system used					
13.6	Quality deliverable					
13.7	Specifications met					
13.8	Delivery of the product/service					

Appendix 3

Mahalanobis distances

Figure A1 Portfolio level Mahalanobis distance with outliers

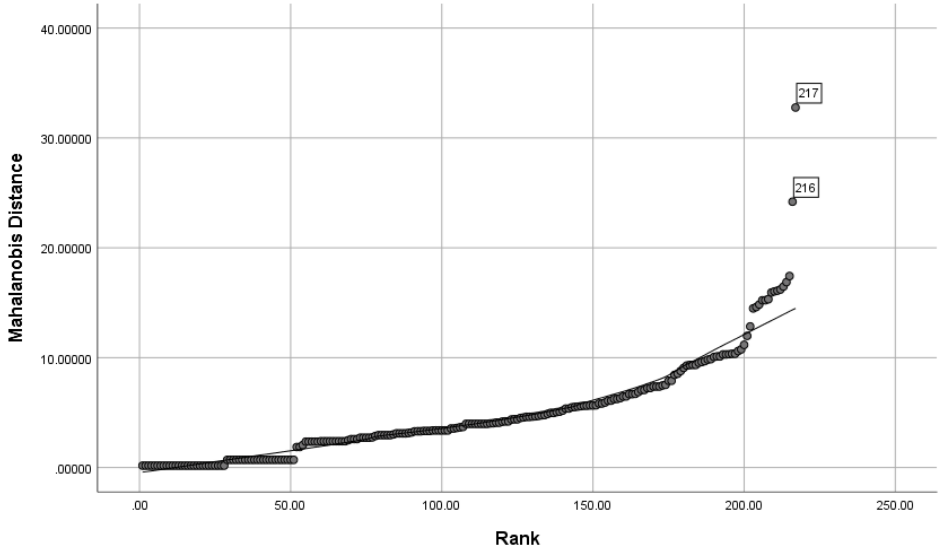


Figure A2 Program level Mahalanobis distance with outliers

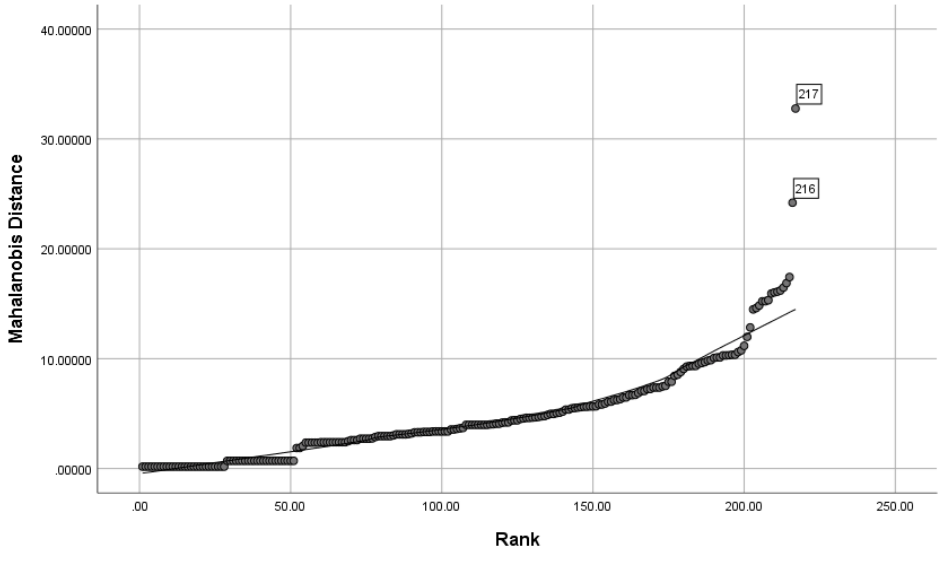
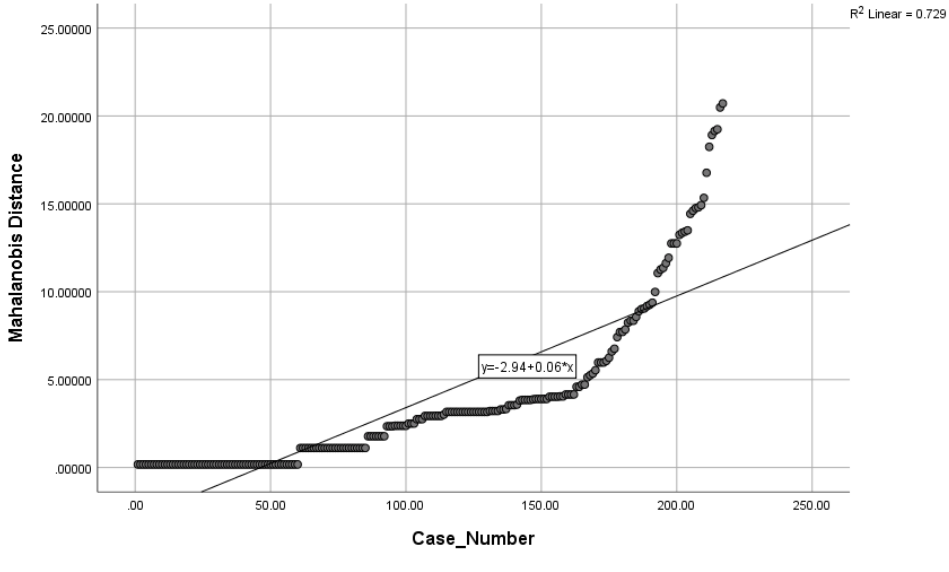


Figure A3 Team level Mahalanobis distance without outliers



Appendix 4

Model summary (R-squared and adjusted R-squared)

Table A6 Portfolio level model summary

Model		*R*	*R square*	*Adjusted R square*	*Std. error of estimate*
1	(Goals and objectives met)	0.617[a]	0.381	0.366	0.73474
2	(Governance)	0.615[a]	0.378	0.364	0.79721
3	(Benefits realisation)	0.620[a]	0.385	0.370	0.79164
4	(Market impact)	0.577[a]	0.332	0.317	0.79980
5	(Industry impact)	0.562[a]	0.316	0.300	0.85232
6	(Competitive impact)	0.604[a]	0.365	0.350	0.80645
7	(Investor impact)	0.643[a]	0.413	0.400	0.71325
8	(Regulator impact)	0.488[a]	0.238	0.220	0.79299
9	(Portfolio's financial benefits)	0.600[a]	0.360	0.345	0.75725
10	(Organisation's strategies with portfolio)	0.574[a]	0.329	0.313	0.78843
11	(Balance of products with organisation's strengths)	0.575[a]	0.330	0.314	0.73938
12	(Success of individual products)	0.594[a]	0.353	0.338	0.71841

Notes: [a] Predictors: (constant), strategy and investment funding, program selection, lean governance, portfolio optimisation, value stream and alignment.

Table A7 Program level regression model summary

Model		*R*	*R square*	*Adjusted R square*	*Std. error of estimate*
1	(Ownership benefits realised)	0.540[a]	0.292	0.265	0.76962
2	(Alignment with program benefits achieved)	0.571[a]	0.326	0.300	0.74731
3	(Compliance with standards met)	0.502[a]	0.252	0.223	0.76646
4	(Stakeholder engagement)	0.448[a]	0.201	0.170	0.89811

Notes: [a] Predictors: (constant), release on demand, PI planning, continuous exploration, compliance with product management standards, continuous integration, system demo, inspect and adapt, continuous deployment.

Table A8 Team level regression model summary

Model		*R*	*R square*	*Adjusted R square*	*Std. error of estimate*
1	(Define)	0.539[a]	0.290	0.267	0.71076
2	(Build)	0.570[a]	0.325	0.302	0.66892
3	(Test)	0.614[a]	0.377	0.357	0.75285
4	(Deploy)	0.591[a]	0.349	0.327	0.76803

Notes: [a] Predictors: (constant), delivery of the product/service, schedule, budget and scope met, specifications met, product/system used, customer satisfaction, quality deliverable, customer acceptance.