# FACTORS AFFECTING THE SUSTAINABILITY OF CONTINUOUS IMPROVEMENT INITIATIVES

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## ABSTRACT

This paper examines factors that affect the sustainability of incremental innovation initiatives such as continuous improvement. Data from five companies was collected to test a proposed continuous improvement sustainability framework. Given that the initial structured of the proposed framework could not be confirmed, exploratory factor analysis was conducted to determine the new structure of the framework. The new framework structured identifies change management, strategic planning, knowledge management, and performance measurement as the key factors that affect the sustainability of the continuous improvement process. Finally, correlation analysis was conducted to discover relationships between the identified factors.

**KEYWORDS:** Continuous improvement, incremental innovation, sustainability

## INTRODUCTION

Engaging in innovation and supporting the activities that unleash creativity and invention are vital to strength the economy (Buckler, 1996; Holtzman, 2008; McAdam, Armstrong, & Kelly, 1998). Continuous improvement (CI) offers many advantages for firms aiming to become innovative. It sets an environment where discovery becomes a learning that can deliver results, and alignment of company and personal objectives (Buckler, 1996; Prajogo & Sohal, 2003). Despite the large advantages and numerous benefits resulting from CI, it is known that CI is still hard to sustain over time (Laraia, Moody, & Hall, 1999).

Jaikumar (1986) and Walton (1987) suggested that organizations willing to take risk and undergo a learning process are focused on providing skills and knowledge to their associates, and proving to be more successful in adopting and implementing change. In these organizations, members are conscious of generating, retaining, and leveraging learning toward performance improvement. Members use tools to monitor and ensure sustainability of learning. Developing learning programs that promote greater focus around a goal, commitment to support continuous learning at operational and management levels to develop strategic thinking, and a culture with an organizational climate which tolerates failure, associated with learning and experimentation are required for change adoption (Jaikumar, 1986; Walton, 1987).

Analyzing the factors that affect the sustainability of CI is necessary to meet the sustainability of it. In the past few years researchers have developed several models to help companies to reach this sustainability, however some of these models are complex, expensive and with a low successful implementation rate (SEI, 2005). Firms need to increase their competitiveness by supporting incremental innovation with tools

such as CI; therefore, the goal of this study is to characterize different factors that affect the CI process and its sustainability. Only by understanding these factors and how they are related, organizations will be able to design a better environment that adopts CI and innovation as their growth strategy.

**Factors Impacting Sustainability of Continuous Improvement**

For a better understanding of the factors that impact the sustainability of the Continuous Improvement, a conceptual research model was created based on similar research (Kaye & Anderson, 1999; Li, 2002; Sánchez, 2011). Also, a literature review was conducted to define the following list of factors that affect the CI process:

- Strategic Management (SM). This construct examines how the management level integrates a plan to accomplish CI as an objective, as well as how this strategic plan is deployed and perceived by associates at all levels (Bessant, Caffyn, Gilbert, Harding, & Webb, 1994; Kaye & Anderson, 1999; Upton, 1996).
- Leadership (LE). This term refers to how formal and informal guidance is exercised across the organization, including the mechanisms developed for decision making, two-way communication, feedback, and development of leaders. Also, it evaluates how values and directions are reinforced (Bessant et al., 1994; Dale, Boaden, Wilcox, & McQuater, 1997; Kaye & Anderson, 1999; Upton, 1996).
- Measurement and Information Deployment (MID). This factor determines to what extent information related to improvement and performance dimensions of outcomes is simple and available to every associate and how systematic is the information deployment (Bessant et al., 1994; Dale et al., 1997; Kaye & Anderson, 1999).
- Operational Management (OM). This factor evaluates the CI management process at the operational level, including how associates are actively involved in identifying needs, solutions, and actions required to solve problems. Also, this factor will examine to which extent CI is becoming part of daily work methods, and how employees are being awarded for contributions (Bessant et al., 1994; Dale et al., 1997; Kaye & Anderson, 1999; Upton, 1996).
- Training (TR). This item determines to what extent training has become a formal process inside the organization, and to what extent it has been applied to functional (Bessant et al., 1994; Dale et al., 1997; Kaye & Anderson, 1999).
- Change Adoption (CA). This item examines how need for change, as improvement, is understood, and the effort the organization is making to adopt new ways to work in order to avoid backsliding to previous practices (Bessant et al., 1994; Dale et al., 1997; Kaye & Anderson, 1999; Marksberry, Badurdeen, Gregory, & Kreafle, 2010).
- CI Sustainability (CIS). This item refers to the sustainability and performance of the CI (Carleton, 2009).

Graphically, the proposed conceptual model is shown in Figure 1.

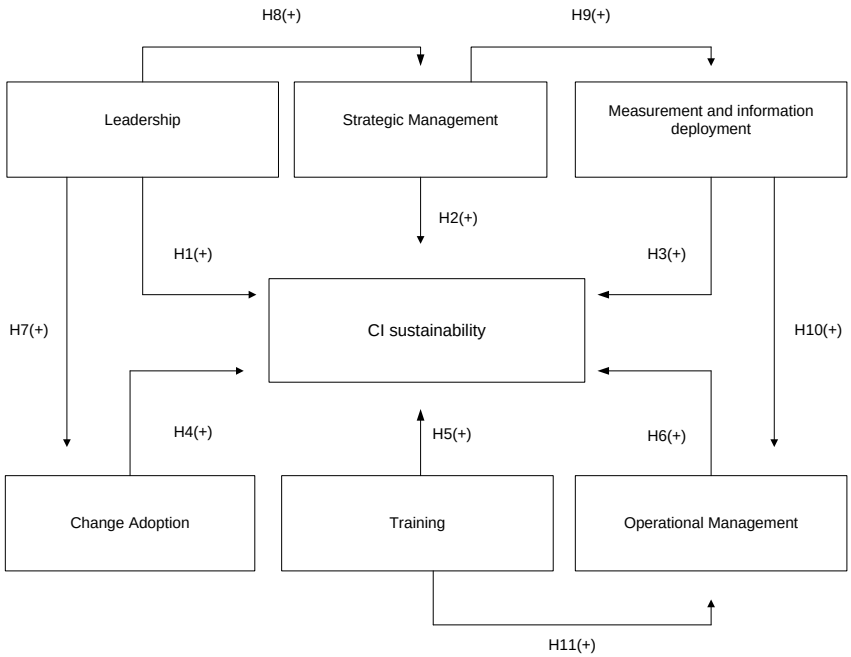


Figure 1. Conceptual research model developed from the literature

The arrows in the model indicate the relationship among the factors. This relationship might be positive or negative. Each factor is composed of a series of directly measured items.

## METHODOLOGY

In order to collect the data required, the researchers surveyed a total of 5 companies. A company from the medical devices, automotive, chemical compounds, wood products, and healthcare management business sector agreed to participate in the study. Manufacturing and services type of industries were chosen as the target population to apply the questionnaires since in both types of industries CI is considered a tool to support innovation (Tipuric & Prester, 2008). Also, companies from two different regions, North America (US) and Central America (CR) were included to obtain information from sources that have limited research performed (SEI, 2005; Van Aken, Letens, Coleman, & Farris, 2005).

Questionnaires were applied from May 2011 through July 2011 and handled directly to the Human Resources Manager or the Continuous Improvement Coordinator, who randomly selected the respondents since the list of employees is considered confidential and access is restricted.

The questionnaire was developed with information from the literature. The questions were divided into large sections. The first section was demographics, where information regarding to the department, role and time working in the company was collected. The second section consisted in items related to the latent variables. The respondent used the Likert scale (1=strongly disagree to 5=strongly agree) to indicate the level of agreement with the statement given in the item. Likert scale was used to provide a consistent response format for further statistical analysis (Blaikie, 2003). Also, the 5-point Likert scale was chosen over the 7-point Likert scale to reduce the respondent burden, and also because having a 7 points scale over a 5 points scaled do not increase reliability (Lissitz & Green, 1975). To ensure validity the questionnaire was reviewed by CI experts and was revised using reviewer's suggestions (Yin, 1984). Table 1 shows the hypothesis testing variables and the literature used to develop them.

Table 1. Hypothesis testing variables

| $H_n$ | Independent Variable | Dependent Variable | Literature Cited |
|---|---|---|---|
| $H_1$ | Leadership | CI Sustainability | Avolio & Luthans, 2006; Tubbs, Husby, & Jensen, 2009 |
| $H_2$ | Strategic Management | CI Sustainability | Brewer, Brewer, & Hawksley, 2000; Ladzani, Smith, & Pretorius, 2010 |
| $H_3$ | Measurement and Information Deployment | CI Sustainability | (Anussornnitisarn, Helo, & Dwight, 2009; Edward, 2007; Hilton & Sohal, 2012) |
| $H_4$ | Change Adoption | CI Sustainability | Atkinson, 1994; Hoover, 2000; Leonard, 1997 |
| $H_5$ | Training | CI Sustainability | Anderson, Dooley, & Rungtusanatham, 1994; Hoover, 2000 |
| $H_6$ | Operational Management | CI Sustainability | Kaye & Anderson, 1999 |
| $H_7$ | Leadership | Change Adoption | Jaimes, 1997; LeBrasseur, Whissell, & Ojha, 2002 |
| $H_8$ | Leadership | Strategic Management | Ladzani et al., 2010; Sadikoglu, 2008 |
| $H_9$ | Strategic Management | Measurement and Information Deployment | (Ladzani et al., 2010; Sinclair & Zairi, 1995) |
| $H_{10}$ | Measurement and Information Deployment | Operational Management | Kaye & Anderson, 1999 |
| $H_{11}$ | Training | Operational Management | Anderson, Dooley, & Rungtusanatham, 1994; Hoover, 2000 |

The ratings of items using Likert scale were compiled to further statistical analysis. To test hypothesis shown in Table 1, the researchers used Confirmatory Factor Analyzes (CFA) to determine the existing relations between each factor, and also CFA was used to confirm each factor's structure.

## RESULTS AND DISCUSSION

### Sample demographics

Questionnaires were applied to 5 different firms in the manufacturing and service fields. Most of the respondents (84%) belong to manufacturing firms. Also, 28% of respondents have job positions that include direct supervision of associates, 25% of respondents are associates working at the operational level (manufacturing operators), 20% have a role that includes direct supervision of associates, 17% hold a management position, 8% of associates have a role as customer service clerk, and 2% are members of the top management team (e.g. director positions). Table 2 shows a summary of respondents also based in their functional areas. Most of the respondents are part of the manufacturing/production area with a response rate of 44%, followed by customer care with 14%, and other such as quality control with 11%.

Table 2. Distribution of respondents per functional area

| Functional Area | Respondents (%) |
|---|---|
| **Manufacturing/Production** | 44 |
| **Customer care** | 14 |
| **Other (e.g. Quality Control)** | 11 |
| **Finance/Accounting** | 10 |
| **Engineering** | 9 |
| **Management** | 3 |
| **Supply Chain** | 3 |

| | |
|---|---|
| **Project Management** | 2 |
| **Human Resources** | 2 |
| **Maintenance/Facilities** | 2 |

Related to the working time at the moment of responding the survey, the majority of the respondents have been working for their company for 5 or more years (55%), 31% have been working for more than 2 years but less than 5 years, and 14% have been part of the company for less than 1 year.

**Cronbach's α Analysis**

The first statistical analysis is the Cronbach's α to test the internal reliability of the questionnaire that is was used. In this research, Cronbach's α shows values ranking from 0.79 to 0.92. Individual values are shown in Table 3. Since all values are acceptable, CFA is conducted to test the hypothesis shown in Table 1.

Table 3. Cronbach's α for individual factors

| Proposed Factor | Variable | Cronbach's α |
|---|---|---|
| **Strategic Management (F1)** | V1 to V12 | 0.93 |
| **Leadership (F2)** | V13 to v21 | 0.90 |
| **Measurement and Information Deployment (F3)** | V22 to V31 | 0.93 |
| **Operational Management (F4)** | V32 to V39 | 0.90 |
| **Training (F5)** | V40 to V47 | 0.89 |
| **Change Adoption (F6)** | V48 to V56 | 0.94 |
| **Continuous Improvement Sustainability (F7)** | V57 to V60 | 0.87 |

**Confirmatory Factor Analysis (CFA)**

In order to perform the CFA, a data reduction technique was used to create a subscale by adding all individual values corresponding to the same factor (Suhr & Shay, 2009). The CFA was performed using the CALIS procedure in the statistical software SAS, and it is used to verify if the model proposed is a good fit to the data by describing similarity of the observed matrices. In this case, the model is not a good fit for the data since the value probability of the statistics Chi-square is less than 0.001. An acceptable model fit is considered if the Chi-square probability is greater than or equal to 0.05. The Comparative Fit Index (CFI) and the Root Mean Square of Approximation (RMSEA) were also calculated having a value of 0.87 and 0.33 correspondingly. An acceptable value for CFI ranges from 0.9 to 1.0 and an acceptable value of good fit using the RMSEA should be less than 0.06.

Since the factor structure was not confirmed, the next step is to revise the structure of each factor individually. By performing a CFA to each construct, it will be able to determine which structures need to be modified in order to design a model that is a good fit for the data.

The summary of statistics for the CFA performed to each individual construct is shown in Table 4. According to these results none out of the 7 factors have a structure that is considered as a good fit for the model (statistically significant). Based on these results, an exploratory factor analysis (EFA) is conducted to determine a factor structure that is statistically acceptable.

Table 4. Results of CFA on individual constructs

| Proposed Factor | Variable | CFA Fit Statistics | | |
|---|---|---|---|---|
| | | $Pr>\chi^2$ | RMSEA | CFI |
| **Strategic Management (F1)** | V1 to V12 | <0.0001* | 0.10* | 0.92 |
| **Leadership (F2)** | V13 to v21 | <0.0001* | 0.09* | 0.93 |
| **Measurement and information deployment (F3)** | V22 to V31 | <0.0001* | 0.20* | 0.82* |
| **Operational Management (F4)** | V32 to V39 | <0.0001* | 0.11* | 0.94 |
| **Training (F5)** | V40 to V47 | <0.0001* | 0.13* | 0.92 |
| **Change Adoption (F6)** | V48 to V56 | <0.0001* | 0.10* | 0.96 |
| **Continuous improvement sustainability (F7)** | V57 to V60 | <0.0001* | 0.28* | 0.93 |

*values out of the acceptance range

**Exploratory Factor Analysis (EFA)**

The EFA was conducted using the statistical software SAS and the FACTOR procedure. The communality estimates used the method of squared multiplied correlations. Factors were retained using a cut-off value of 1 based on the Kaiser criterion for the Eigenvalues. The maximum likehood was used as the extraction method followed with a varimax rotation. This analysis resulted in 5 factors that can be retained by the Kaiser criterion. In addition to this criterion , the scree plot test (Cattell, 1966) was used to confirm the number of factors. By using this rule it was observed that the curve based on Eigenvalues formed an elbow that indicated 5 factors. Given this, 5 factors were retained. These 5 factors account for 80% of the total variance. For each factor, all items with a load equal or greater than 0.50 were assigned to the corresponding factor. Using 0.50 as the cut off value, 8 items were deleted from the model.

The first factor was named Change Management (CM). All items with loadings higher than 0.5 were grouped in Factor 1 and are related to Change Adoption, Training and Operations Management according to previous research by Bessant et al. (1994), Dale et al. (1997), Kaye and Anderson (1999) and Marksberry et al. (2010). Items with loadings lower than 0.50 or heavy loads in multiple factors were eliminated. After the assignment of the items to Factor 1, a Cronbach's α analysis was performed and an acceptable value of 0.96 was obtained. The new structure for Factor 1 is shown in Table 5.

Table 5. Structure of Factor 1 after EFA and Cronbach's α analysis

| Item | Description | F1 | F2 | F3 | F4 | F5 | Factor | α value |
|---|---|---|---|---|---|---|---|---|
| **V47** | Openness to learn from CI | 0.66 | 0.32 | 0.44 | 0.13 | 0.00 | Change Management | 0.96 |
| **V54** | Use of success stories to support CI | 0.64 | 0.16 | 0.45 | 0.11 | 0.08 | | |
| **V49** | New responses to problems | 0.72 | 0.28 | 0.31 | 0.17 | 0.10 | | |
| **V51** | Portfolio of lessons learned | 0.70 | 0.19 | 0.31 | 0.28 | 0.05 | | |
| **V46** | Promotion of risk taking | 0.60 | 0.26 | 0.40 | 0.11 | 0.00 | | |
| **V56** | Support to embrace change | 0.66 | 0.33 | 0.31 | 0.24 | 0.06 | | |
| **V50** | New ideas are worthy to spread | 0.66 | 0.29 | 0.30 | 0.31 | 0.07 | | |
| **V52** | Leaders role model change by adopting CI initiatives | 0.70 | 0.33 | 0.22 | 0.30 | -0.10 | | |
| **V53** | Feedback system to avoid backsliding | 0.51 | 0.32 | 0.47 | 0.21 | 0.04 | | |
| **V44** | Active role of managers in CI | 0.70 | 0.25 | 0.19 | 0.18 | 0.01 | | |
| **V45** | Failure as a learning opportunity | 0.61 | 0.36 | 0.30 | 0.19 | -0.01 | | |
| **V35** | CI empowered employees | 0.54 | 0.39 | 0.39 | 0.19 | 0.05 | | |
| **V55** | Awareness on needs and benefits of CI | 0.53 | 0.37 | 0.37 | 0.25 | 0.01 | | |
| **V19** | Awards towards innovation and creativity | 0.51 | 0.49 | 0.34 | 0.03 | 0.06 | | |
| **V34** | Customer requirements are linked | 0.53 | 0.44 | 0.32 | 0.21 | 0.05 | | |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | to employees' CI proposals | | | | | | | |
| **V20** | Existence of a CI leader | 0.66 | 0.34 | 0.05 | 0.14 | -0.05 | | |

The second factor is called Strategic Planning (SP). The items with loads above or equal than 0.5 were classified as Factor 2 items. These items are mainly related to strategic management and leadership corresponding to previous work done by Bessant et al. (1994), Upton et al. (1996) and Kaye and Anderson (1999). Items with loadings lower than 0.50 or heavy loads in multiple factors were eliminated. After the assignment of the items to Factor 2, a Cronbach's α analysis was performed and an acceptable value of 0.94 was obtained. The new structure for Factor 2 is shown in Table 6.

Table 6. Structure of Factor 2 after EFA and Cronbach's α analysis

| Item | Description | F1 | F2 | F3 | F4 | F5 | Factor | α Value |
|---|---|---|---|---|---|---|---|---|
| **V16** | CI as an element of the vision and mission | 0.37 | 0.68 | 0.13 | 0.21 | 0.00 | Strategic Planning | 0.94 |
| **V14** | Improvement as an element for the company's existence | 0.21 | 0.66 | 0.11 | 0.18 | -0.10 | | |
| **V7** | Effective CI review/adjustment process | 0.28 | 0.64 | 0.29 | 0.17 | 0.06 | | |
| **V15** | CI modeling by managers at improving processes | 0.35 | 0.62 | 0.14 | 0.29 | 0.03 | | |
| **V10** | Frequent monitoring of CI goals | 0.17 | 0.62 | 0.31 | 0.28 | 0.07 | | |
| **V13** | CI as a working value | 0.35 | 0.61 | 0.19 | 0.16 | -0.04 | | |
| **V4** | Systematic revision and adjustment of CI goals | 0.21 | 0.61 | 0.25 | 0.25 | 0.00 | | |
| **V2** | Departmental CI metrics in alignment with company CI goals | 0.21 | 0.60 | 0.18 | 0.40 | 0.03 | | |
| **V12** | Understanding of CI goals at every level | 0.23 | 0.59 | 0.35 | 0.32 | -0.11 | | |
| **V9** | Effective communication of process improvements | 0.18 | 0.58 | 0.21 | 0.27 | -0.03 | | |
| **V5** | Company's north is CI to meet requirements | 0.34 | 0.56 | 0.18 | 0.07 | -0.02 | | |
| **V8** | CI resources can be located across all the organization | 0.44 | 0.56 | 0.31 | 0.11 | 0.07 | | |
| **V6** | Communication of CI goals | 0.19 | 0.55 | 0.17 | 0.41 | 0.08 | | |
| **V3** | CI goals set based on collected data | 0.23 | 0.55 | 0.30 | 0.28 | -0.06 | | |
| **V11** | Displayed goals linked to CI goals | 0.47 | 0.53 | 0.33 | 0.18 | 0.12 | | |

The third factor is named Knowledge Management (KM). Items assigned to this factor show a load above 0.5. These items were identified as part of Measurement and Information Deployment and Training according to Bessant *et al*., 1994; Dale *et al*., 1997; Kaye & Anderson, 1999. After assigning the corresponding items, a Cronbach's α analysis was performed resulting in a value of 0.94. Table 7 shows the structure for Factor 3.

Table 7. Structure of Factor 3 after EFA and Cronbach's α analysis

| Item | Description | F1 | F2 | F3 | F4 | F5 | Factor | α Value |
|---|---|---|---|---|---|---|---|---|
| **V30** | Electronic data base with CI experiences | 0.26 | 0.26 | 0.74 | 0.23 | 0.09 | Knowledge Management | 0.94 |
| **V31** | CI data electronic management | 0.27 | 0.37 | 0.70 | 0.29 | 0.07 | | |
| **V39** | New technologies for CI of process and products | 0.35 | 0.15 | 0.67 | 0.12 | -0.08 | | |
| **V28** | IT support for CI deployment | 0.32 | 0.26 | 0.64 | 0.24 | 0.05 | | |
| **V29** | Timely CI reporting | 0.23 | 0.24 | 0.64 | 0.30 | 0.00 | | |
| **V40** | CI as an element of induction training | 0.35 | 0.29 | 0.59 | 0.25 | 0.08 | | |
| **V41** | Continuous training on CI techniques | 0.39 | 0.23 | 0.55 | 0.32 | 0.02 | | |
| **V43** | Established training for CI | 0.37 | 0.26 | 0.54 | 0.32 | 0.07 | | |
| **V36** | CI goals are cross linked among departments | 0.25 | 0.23 | 0.54 | 0.40 | -0.02 | | |
| **V38** | CI as an integral approach for problem solving | 0.48 | 0.30 | 0.50 | 0.21 | 0.04 | | |

Factor 4 is called Performance Measurement (PM), and items belonging to this factor have a load higher than 0.5. Items assigned to factor 4 are related to Measurement and Information Deployment Strategic according to Bessant *et al*., 1994; Dale *et al*., 1997; Kaye & Anderson, 1999. A Cronbach's α analysis was performed to ensure internal reliability, obtaining a value of 0.92. Table 8 shows the new structure for Factor 4

Table 8. Structure of Factor 4 after EFA and Cronbach's α analysis

| Item | Description | F1 | F2 | F3 | F4 | F5 | Factor | α Value |
|---|---|---|---|---|---|---|---|---|
| **V22** | Existence of CI metrics boards | 0.12 | 0.31 | 0.15 | 0.70 | 0.15 | Performance Measurement | 0.92 |
| **V23** | Displayed CI are consistent with departmental goals | 0.17 | 0.34 | 0.23 | 0.70 | 0.14 | | |
| **V25** | Operational metrics as CI metrics | 0.17 | 0.28 | 0.33 | 0.70 | -0.01 | | |
| **V27** | CI goals linked to customer requirements | 0.24 | 0.28 | 0.32 | 0.64 | 0.16 | | |
| **V24** | Longitudinal CI metrics | 0.33 | 0.24 | 0.38 | 0.64 | 0.00 | | |
| **V26** | Lessons learned shared across departments | 0.34 | 0.30 | 0.34 | 0.51 | 0.09 | | |
| **V1** | CI metrics as strategic objectives | 0.30 | 0.46 | 0.17 | 0.51 | -0.02 | | |

The last factor is named CI Sustainability (CIS). To assign the corresponding items, a cut off higher or equal to 0.50 was used. Items with lower loads or heavy load in more than one factor were eliminated. The identified items are related to the performance and sustainability of the CI process as indicated by Carleton (2009). A Cronbach's α analysis was perfomed obtaining an acceptable value of 0.87. Table 9 shows the structure for Factor 5.0

Table 9. Structure of Factor 5 after EFA and Cronbach's α analysis

| Item | Description | F1 | F2 | F3 | F4 | F5 | Factor | α value |
|---|---|---|---|---|---|---|---|---|
| **V59** | Measurement of effective CI training completion | 0.07 | -0.03 | 0.06 | 0.03 | 0.86 | CI Sustainability | 0.87 |
| **V58** | Measurement of effective waste reduction | 0.06 | 0.03 | 0.02 | 0.09 | 0.82 | | |
| **V60** | Belief of sustainability of the CI process | -0.05 | -0.04 | -0.05 | -0.04 | 0.79 | | |
| **V57** | Continuous use of CI initiatives | 0.03 | 0.02 | 0.06 | 0.2 | 0.75 | | |

In summary 5 factors are retained after EFA analysis and internal consistency test using Cronbach's α. The structure of these factors is as follows:

Change Management (V49, V44, V51, V52, V20, V56, V50, V47, V54, V45, V46, V35, V55, V34, V53, V19)

Strategic Planning (V16, V14, V7, V15, V10, V13, V4, V2, V12, V9, V5, V8, V6, V3, V11)

Knowledge Management (V30, V31, V39, V28, V29, V40, V41, V43, V36, V38)

Performance Measurement (V22, V23, V25, V27, V24, V26, V1)

CI Sustainability (V59, V58, V60, V57)

For further analysis of the existing relationships between the 5 retained factors, a correlation analysis was performed. This analysis was performed using the CORR procedure in SAS. The data was entered using subscales (a sum of the items corresponding to each new factor). The results of the correlation analysis are shown in Table 10. Figure 2 depicts the scatter plot for the correlations.

Table 10. Pearson correlations and p values for the new factors

| Factor | CM (Factor 1) | SP (Factor 2) | KM (Factor 3 | PM (Factor 4) | CIS (Factor 5 |
|---|---|---|---|---|---|
| **CM (Factor 1)** | 1 | 0.79 <0.0001 | 0.79 <0.0001 | 0.69 <0.0001 | 0.64 <0.0001 |
| **SP (Factor 2)** | | 1 | 0.75 <0.0001 | 0.73 <0.0001 | 0.65 <0.0001 |
| **KM (Factor 3)** | | | 1 | 0.68 <0.0001 | 0.59 <0.0001 |
| **PM (Factor 4)** | | | | 1 | 0.63 <0.0001 |
| **CIS (Factor 5)** | | | | | 1 |

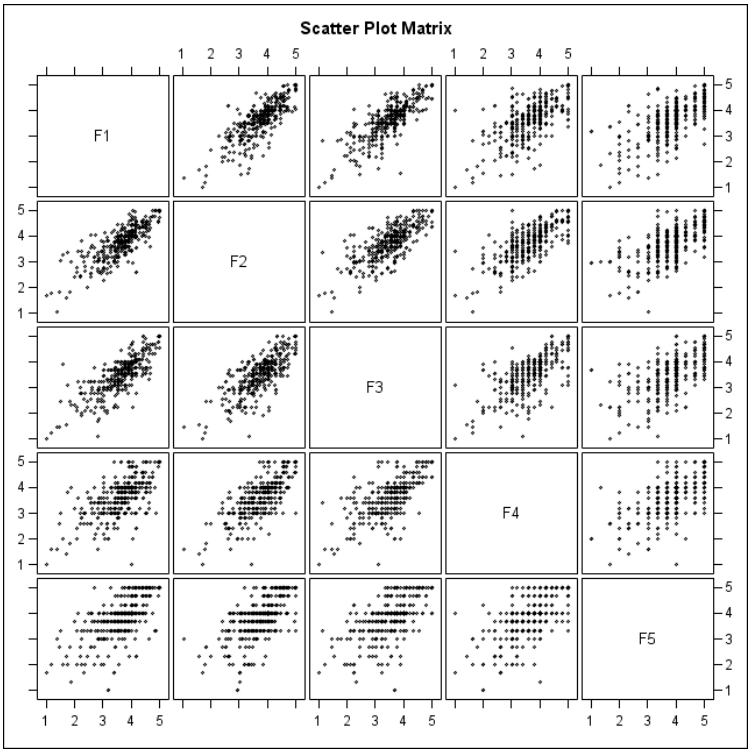


Figure 2. Scatter Plot Matrix for correlations

Field & Miles, 2010 stated that correlation values above or equal to 0.30 are considered moderated suggesting that further examination is needed. Based on this criterion, all the correlations in this case are considered strong and significant (p-values <0.05). The scatter plot shown in Figure 2 visually indicates a well-defined linear pattern between factors CM (factor 1) and SP (factor 2), CM (factor 1) and KM (factor 3), SP (factor 2) and KM (factor 3), and KM (factor 3) and PM (factor 4). However the scatter plot linear patterns are not that clear when factors 1 through 4 are correlated with the factor CIS (factor 5). The

importance of factors CM and SP (highest correlations) as constructs to support factors KM and PM is shown here.

**Discussion and Conclusions**

This work builds in previous research that characterizes the main factors impacting the sustainability of the continuous improvement process. The sampling was constituted by employees from five different companies in the automotive, wood products, medical devices; healthcare management and chemical sectors. Companies were located in two different countries. The employees' perceptions regarding strategic management, leadership, change adoption, training, operational management, measurement and information deployment and sustainability of continuous improvement were tested based on a conceptual model drawn from the literature. The internal reliability of each proposed factor was tested after data collection. Based on the acceptance of the internal reliability, confirmatory factor analysis (CFA) was conducted. The results from the CFA indicated that relationships were not confirmed. Therefore; a CFA on each individual factor was performed but none of the relationships tested was confirmed. Given this new result; exploratory factor analysis (EFA) was conducted to determine the new structure of the factors. The EFA analysis showed that some items did not have significant loads on their original factors. Hence; items with loads below than 0.5 were eliminated or moved to a new factor and new factors were renamed. After conducting EFA, the internal reliability test was performed to verify the new structure of the factors and correlation analysis was conducted to determine the potential relationships between the new factor structures.

The highest correlations were observed between change management (CM) and knowledge management (KM) and CM with strategic planning (SP) with a Pearson correlation value of 0.79 in both cases. This finding might suggest that organizations where associates are constantly involved not only as practitioners of the CI but also as managers of the CI results (such as lessons learned) are more supportive of the change resulting from implementing CI initiatives. The strong correlation between CM and SP (0.79) might suggest that strategic organizational is better understood by the associates. When reasons for change are companywide, linked to performance, and previously communicated; it is easy for members of the company to adopt and embed into the company´s culture. This continuous embracing of planned change also helps to develop skills to adopt unexpected but positive change.

Strategic planning (SP) and knowledge management (KM), and strategic planning (SP) and performance measurement (PM) resulted in Pearson correlation values of 0.75 and 0.73 respectively. PM has a vital role by following up and show progress on goals defined for CI as part of the strategic plan; also managing the knowledge build upon CI practices is vital information for the CI strategic goals review process.

Performance management (PM) and knowledge management (KM) are also correlated according to results (Pearson correlation value of 0.68). This finding might suggest that it is highly important not only to track performance goals but also to link this performance to specific CI initiatives in order to understand what initiatives are adding value to the processes inside the firm. By understanding correlation, KM could develop a set of good practices and lessons learned to develop training and proven problem solutions.

Finally, the new factor structure found in this research account for 80% of the variability of the data collected, which is considered an acceptable value. These factors and their corresponding items are designed to help practitioners from industry to understand how the CI sustainability is driven, and what is necessary to achieve its performance in the long term. If these drivers are known, companies from different business sectors can develop strategies to improve the variables (items) corresponding to each factor. If companies have a detailed focus, awareness of CI will be increased at every level of the organization.

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