Table 1 – Learning dimensions according to DLOQ (adapted from Kim and Marsick, 2013)

|  |  |  |
| --- | --- | --- |
| Dimension | Definition | Statements |
| Create continuous learning opportunities | Learning is designed in a way that individuals learn by working; opportunities are provided for growth and education. | From 1 to 7 |
| Promote dialogue | Individuals obtain skills to express their vision and capacity to listen to others' vision; culture is changed to support questioning, feedback, and experimentation. | From 8 to 13 |
| Encourage collaboration and team learning | Tasks are conceived so that teams present different ways of thinking; it is expected that teams learn together; collaboration is culturally valued and recognized. | From 14 to 19 |
| Create systems to capture and share learning | Technology systems are created and integrated into tasks; systems are maintained, and access is provided. | From 20 to 25 |
| Empower individuals into a collective vision direction | Individuals are involved in establishing and implementing the vision; the decision process is decentralized, and the responsibility is distributed in order to stimulate individuals to own the change. | From 26 to 31 |
| Connect organization and its environment | Individuals are helped to see the effect of their jobs on the organization as a whole; the organization is connected to its community. | From 32 to 37 |
| Provide strategic leadership for learning | Leadership uses learning in a strategic way to generate results for the business. | From 38 to 43 |

Table 2 **–** EFA to validate I4.0 base technologies construct

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| I4.0 base technologies | Mean | Std. Dev. | | Communalities | | Factor loadings |
| Analytics (e.g., machine learning and data mining) | 2.600 | 1.271 | | 0.807 | | 0.898 |
| Cloud computing | 2.593 | 1.180 | | 0.654 | | 0.808 |
| IoT | 2.526 | 1.215 | | 0.585 | | 0.765 |
| Big Data | 2.756 | 1.330 | | 0.781 | | 0.884 |
| Eigenvalues | 2.826 | | | | | |
| Extraction sum of squared loadings (total) | 2.826 | | | | | |
| Percent of variance explained | 70.655 | | | | | |
| Cronbach α (sample *n* = 135) | 0.860 | | | | | |
| Bartlett's test of sphericity |  | | 347.55 (df 6. *p*-value < 0.001) | | | |
| Kaiser-Meyer-Olkin measure of sampling adequacy |  |  | | | 0.699 | |

Extraction Method: Principal component analysis. Rotation Method: Varimax.

Table 3 – CFA for learning dimensions

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Learning dimensions | Items | Factor loadings | χ2/df | CFI | SRMR | AVE | Cronbach's alpha | Composite reliability |
| Create continuous learning opportunities | In my organization, people have open discussions about errors and ways to learn from them | 0.7423 | 40.28/14\* | 0.954 | 0.049 | 0.64 | 0.829 | 0.767 |
| In my organization, people identify needed skills for future activities | 0.7710 |
| In my organization, people help each other to learn | 0.7183 |
| In my organization, people receive financial help to support learning | 0.6387 |
| In my organization, people have available time to support learning | 0.4501 |
| In my organization, people see problems as learning opportunities | 0.8581 |
| In my organization, people are rewarded by learning | 0.6501 |
| Promote dialogue | In my organization, people give open feedback to each other | 0.8466 | 22.64/5\* | 0.961 | 0.027 | 0.67 | 0.907 | 0.870 |
| In my organization, people listen to others opinion before talking | 0.8777 |
| In my organization, people are encouraged to ask why | 0.8480 |
| In my organization, when people say their opinion, they also ask others what they think | 0.8398 |
| In my organization, people treat each other with respect | *Excluded* |
| In my organization, people use time to build trust among them | 0.6541 |
| Encourage collaboration and team learning | In my organization, teams are free to adapt their targets according to the need | *Excluded* | 22.59/5\* | 0.955 | 0.033 | 0.67 | 0.893 | 0.845 |
| In my organization, teams treat their members as equals | 0.7543 |
| In my organization, teams focus both, the task and how well the team is performing | 0.8497 |
| In my organization, teams review their opinion according to data or discussions | 0.8208 |
| In my organization, teams are rewarded by their results as teams | 0.7676 |
| In my organization, teams trust that the organization will act according to their suggestion | 0.7814 |
| Create systems to capture and share learning | My organization uses 2-way communication in a regular way | 0.7523 | 20.27/5\* | 0.959 | 0.035 | 0.63 | 0.893 | 0.840 |
| My organization allows people to have easy and fast access to needed information at any time | 0.7977 |
| My organization keeps a data base with employees' skills | 0.8297 |
| My organization creates systems to measure expected and actual performance | 0.7974 |
| My organization keeps available knowledge to all employees | 0.7812 |
| My organization tracks time and money invested on training | *Excluded* |
| Empower individuals into a collective vision direction | My organization recognizes people by their initiative | 0.7048 | 18.20/5\* | 0.964 | 0.031 | 0.72 | 0.886 | 0.829 |
| My organization gives people choice on their tasks | *Excluded* |
| My organization invites people to contribute to the business vision | 0.7673 |
| My organization empowers people regarding resources to complete their tasks | 0.7624 |
| My organization supports employees that risk in a safe way | 0.8769 |
| My organization aligns vision across different teams and work levels | 0.7940 |
| Connect organization and its environment | My organization helps employees balance work and family time | *Excluded* | 12.2/5\* | 0.982 | 0.025 | 0.71 | 0.900 | 0.857 |
| My organization encourages people to think in a global way | 0.7947 |
| My organization encourages people to bring the customer perspective to business | 0.8324 |
| My organization considers the decisions impact over employees' morale | 0.8377 |
| My organization works with local community to meet common needs | 0.7086 |
| My organization encourages people to develop problem solving inside the company | 0.8474 |
| Provide strategic leadership for learning | In my organization, leaders generally support learning and training opportunities | 0.7816 | 32.08/9\* | 0.960 | 0.032 | 0.69 | 0.910 | 0.895 |
| In my organization, leaders share information with employees about market trends, etc. | 0.7950 |
| In my organization, leaders empower others to help achieve company's vision | 0.8352 |
| In my organization, leaders are mentors and develop their teams | 0.8573 |
| In my organization, leaders continuously look for learning opportunities | 0.8216 |
| In my organization, leaders make sure that attitudes are consistent with company's values | 0.8453 |

Note: \* Significant at 1%.

Table 4 – Pairwise correlations

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 |
| 1-Base technologies | - | -0.824\* | -0.718\* | -0.803\* | -0.745\* | -0.737\* | -0.763\* | -0.757\* |
| 2-Create continuous learning opportunities |  | - | 0.798\* | 0.777\* | 0.749\* | 0.770\* | 0.785\* | 0.762\* |
| 3-Promote dialogue |  |  | - | 0.813\* | 0.643\* | 0.738\* | 0.765\* | 0.717\* |
| 4-Encourage collaboration and team learning |  |  |  | - | 0.723\* | 0.794\* | 0.812\* | 0.784\* |
| 5-Create systems to capture and share learning |  |  |  |  | - | 0.750\* | 0.755\* | 0.664\* |
| 6-Empower individuals into a collective vision direction |  |  |  |  |  | - | 0.840\* | 0.755\* |
| 7-Connect organization and its environment |  |  |  |  |  |  | - | 0.825\* |
| 8-Provide strategic leadership for learning |  |  |  |  |  |  |  | - |

Note: \* Significant at 1%.

Table 5 – Comparison of models for learning dimensions

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| Learning dimension | Model |  | | | | | |
| *R*2 | *F*-value | Constant | *b*1 | *b*2 | *b*3 |
| Create continuous learning opportunities | Linear | 0.67 | 279.87\*\*\* | 0.001 | 0.820 |  |  |
| **Nonlinear** | **0.69** | 95.51\*\*\* | -0.002 | 0.635 | -0.006 | 0.099 |
| Promote dialogue | Linear | 0.51 | 142.27\*\*\* | 0.001 | 0.716 |  |  |
| **Nonlinear** | **0.53** | 48.96\*\*\* | -0.053 | 0.542 | 0.046 | 0.091 |
| Encourage collaboration and team learning | **Linear** | **0.64** | 239.33\*\*\* | 0.001 | 0.799 |  |  |
| Nonlinear | 0.64 | 78.97\*\*\* | -0.036 | 0.797 | 0.036 | -0.001 |
| Create systems to capture and share learning | Linear | 0.55 | 165.18\*\*\* | 0.001 | 0.742 |  |  |
| **Nonlinear** | **0.58** | 59.08\*\*\* | -0.019 | 0.467 | 0.007 | 0.151 |
| Empower individuals into a collective vision direction | Linear | 0.51 | 141.903\*\*\* | 0.001 | 0.716 |  |  |
| **Nonlinear** | **0.52** | 47.31\*\*\* | 0.029 | 0.588 | -0.034 | 0.069 |
| Connect organization and its environment | Linear | 0.58 | 185.06\*\*\* | 0.001 | 0.760 |  |  |
| **Nonlinear** | **0.59** | 62.62\*\*\* | 0.006 | 0.583 | 0.014 | 0.095 |
| Provide strategic leadership for learning | **Linear** | **0.57** | 179.27\*\*\* | 0.001 | 0.755 |  |  |
| Nonlinear | 0.57 | 58.96\*\*\* | -0.013 | 0.727 | 0.012 | 0.015 |

Notes: \*\*\* Significant at 1%. The independent variable is the adoption level of I4.0 base technologies. Bold cells indicate the selected model.