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# **Title:** Predictive relationship of knowledge management and business innovation: A model based on PLS structural equations.

**Authors:** VILLALOBOS-ALONZO, María de los Ángeles y ROMO-GONZÁLEZ, Ana Eugenia.

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**ECORFAN-México, S.C.**
143 – 50 Itzopan Street
La Florida, Ecatepec Municipality
Mexico State, 55120 Zipcode
Phone: +52 1 55 6159 2296
Skype: ecorfan-mexico.s.c.
E-mail: contacto@ecorfan.org
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# Contents

# Introduction

## PLS

**Origin Structural Equation Model**

"Multivariate analysis tool widely used in the field of economics and social sciences" (Céspedes y Sánchez, 1996).

**Partial Least Squares (PLS)**

Its objective is the prediction of latent variables, they help to link data and theory.

**Use**

"The estimation of ordinary least squares, principal component analysis, Path analysis and regression" (Cepeda y Roldán, 2007).

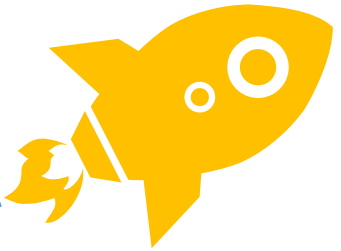
**Appropriate**

For predictive purposes, the development of a nascent theory and create a flexible model of relationships between predictive variables (independent, exogenous) and criteria variables (dependent or endogenous).

**Characteristics of the estudy**

It uses relational hypotheses, with exploratory scope in the investigation.

# Introduction



## Objetive

Describe the predictive relationship of knowledge management and business innovation through the modeling of partial least squares and its procedure.

Supposition

Source: Women and science, Temisasm Astronomical Observatory, (2019).

# Introduction

**Structural hypothesis:**

There is a positive relationship of predictive and significant interdependence of the variances of the endogenous variables that make up the internal conditions (innovative performance, innovation of exploration, exploitation and ambidestreza and organizational culture) and external conditions (Company-University collaboration, competitiveness and business innovation indicators) and the exogenous variable knowledge management practices in the structural model for the development of innovation capabilities.

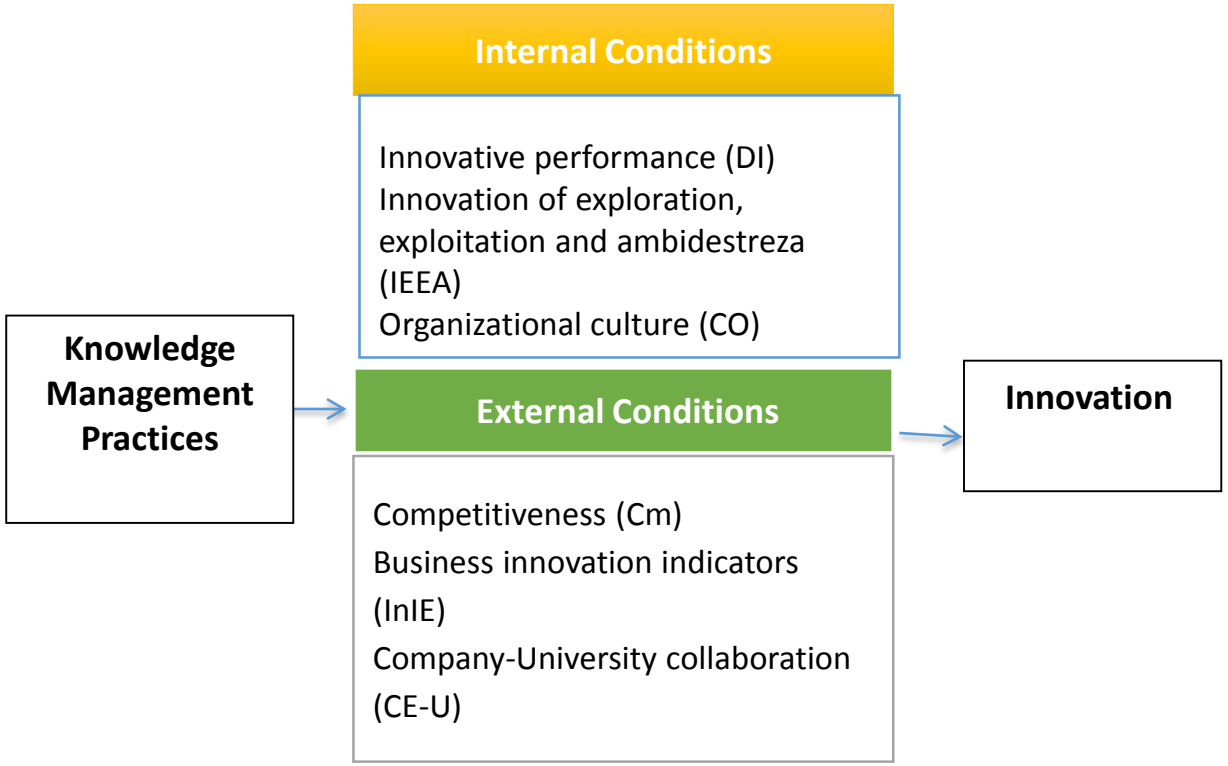



**Figure 1 Relationship of the general multivariate hypothesis. Source: self made**

# Methodology

**Validity**

- Content Judges (Kerlinger y Lee, (2002). Kappa de Fleiss 0.861
- Criterion (Phares y Trull, 2003). Pearson 0.690** a 0.808**
- Construct (Hernandez, 2013). Factorial analysis. KMO superior 0,5 (0.522 a 0.945)

**Reliability**

Alpha de Cronbach

**ACIEAT digital survey**

AT companies: 15 multi-response items.
Knowledge management practices: 15 dichotomous items.
Research capabilities: 27 Likert items.
(Alonzo y González, 2015).

**Applied to 112 companies in the Industrial:**

62 y 63 | 26 y 27 | 28 | 29

**Analysis of results**

**Group Variables**

Exploratory Factor Analysis (Varimax rotated component matrix extraction method).
25 significant factors to each other.

**Analysis of results**

**Hypothesis Check**

1. Bivariate analysis (Sperman correlation).
2. Partial Least Squares (PLS).

**PLS**

**A. Measure Model**

Cronbach's Alpha Reliability
Convergent Validity
Divergent Validity

**B. Structural Model**

$R^2$ indicates the amount of "variance of the construct that is explained by the model" (Cepeda y Roldán, 2007).
The path coefficient or standardized regression weights is identified in the monogram.

.

# Results Measure Model

The analysis of the measurement model according to Cepeda and Roldán, (2007), Barroso, (2007), Chin, (1998) and Fornell, (1982) involves the analysis of individual item reliability, internal consistency or reliability of a scale, convergent validity analysis and discriminate validity.

**Cronbach´s Alpha Reliability**

| Variables | Component | Question Code | α ítem |
|---|---|---|---|
| Knowledge management practices $p_c$=0,876 α=0,779 | Available storage systems | PG! | 0,735 |
| | Shared knowledge spaces | PG2 | 0,669 |
| | Collaborative Learning | PG3 | 0,673 |
| | Knowledge application | PG4 | 0,902 |
| | | DI5 | 0,932 |
| Internal Conditions $p_c$=0,953 α=0,811 | Innovative performance | DI6 | 0,699 |
| | $p_c$ =0,873 α=0,831 | DI7 | 0,808 |
| | | DI8 | 0,674 |
| | Innovation of exploration, exploitation and ambidestreza $p_c$=0,638 α=0,626 | IEEA9 | 0,620 |
| | | IEEA10 | 0,639 |
| | Organizational culture | OC11 | 0,866 |
| | $p_c$=0,953 | OC12 | 0,896 |
| | α=0,944 | 0C13 | 0,970 |
| External Conditions $p_c$=0,940 α=0,922 | Company-University collaboration | CE-U14 | 0,646 |
| | $p_c$=0,737 | CE-U15 | 0,794 |
| | α=0,629 | CE-U16 | 0,622 |
| | | CE-U17 | 0,629 |
| | Competitiveness | Cm18 | 0,831 |
| | $p_c$=0,890 | Cm19 | 0,843 |
| | α=0,878 | Cm20 | 0,873 |
| | | Cm21 | 0,825 |
| | Business innovation indicators | InIE22 | 0,961 |
| | $p_c$=0,979 | InIE23 | 0,983 |
| | α=0,978 | InIE23 | 0,967 |
| | | InIE25 | 0,972 |

**Table 1 Analysis of the PLS average model.**
*Calculations made in SmartPLS3.0*

Reliability criteria: 0.6 (low); 0.61 to 0.70 (appropriate); 0.71 to 0.80 (good); greater than 0.80 (high) (Nunnally, 1978).

# Results Measure Model

**Convergent validity**, which describes whether the different items intended to measure a concept or construct really measure the same, then the items will be significant and highly correlated (Cepeda y Roldán, 2007).

**Convergent Validity**

| | Component | KMP | Internal Conditions 1 | 2 | 3 | External Conditions 4 | 5 | 6 | AVE |
|---|---|---|---|---|---|---|---|---|---|
| | Knowledge management practices | 0,527 | | | | | | | **0,586** |
| Internal Conditions | 1. Innovative performance | | 0,867 | | | | | | **0,752** |
| Internal Conditions | 2. Innovation of exploration, exploitation and ambidestreza | | -0,020 | 0,904 | | | | | **0,817** |
| Internal Conditions | 3. Organizational culture | | 0,711 | 0,261 | 0,955 | | | | **0,913** |
| External Conditions | 4. Company-University collaboration | | | | | 0,685 | | | **0,569** |
| External Conditions | 5. Competitiveness | | | | | 0,835 | 0,859 | | **0,918** |
| External Conditions | 6. Business innovation indicators | | | | | 0,739 | 0,783 | 0,970 | **0,941** |

**Table 2 Convergent validity matrix.**
*Calculations made in SmartPLS3.0*

In general, the constructs that make up the model obtained the AVE value greater than 0.50 (Fornell, 1982), complying with the convergent validity condition.

# Results Measure Model

According to Chin, (1998) the discriminant validity that is the shared variance between the construct and its measures. This measure should be greater than the variance shared between the construct with the other constructs (square correlation between the two constructs).

| Discriminant validity | | | | |
|---|---|---|---|---|
| **Component** | **Innovation of exploration, exploitation and ambidestreza** | **Innovative performance** | **Organizational culture** | **Knowledge management practices** |
| DI5 | -0.162 | 0.565 | 0.942 | 0.281 |
| DI6 | 0.040 | 0.973 | 0.589 | 0.391 |
| DI7 | 0.157 | 0.874 | 0.295 | 0.286 |
| DI8 | -0.087 | 0.990 | 0.665 | 0.455 |
| IEEA10 | 0.887 | -0.126 | -0.260 | -0.423 |
| IEEA9 | 0.920 | 0.074 | -0.217 | -0.498 |
| OC11 | -0.375 | 0.569 | 0.978 | 0.434 |
| OC12 | -0.162 | 0.565 | 0.942 | 0.281 |
| OC13 | -0.186 | 0.856 | 0.946 | 0.462 |
| PG1 | -0.524 | 0.395 | 0.421 | 0.989 |
| PG2 | -0.274 | 0.424 | 0.327 | 0.737 |
| PG3 | -0.335 | 0.402 | 0.334 | 0.778 |
| PG4 | -0.133 | 0.263 | 0.310 | 0.500 |

**Table 3 Convergent validity matrix.**
*Calculations made in SmartPLS3.0.*

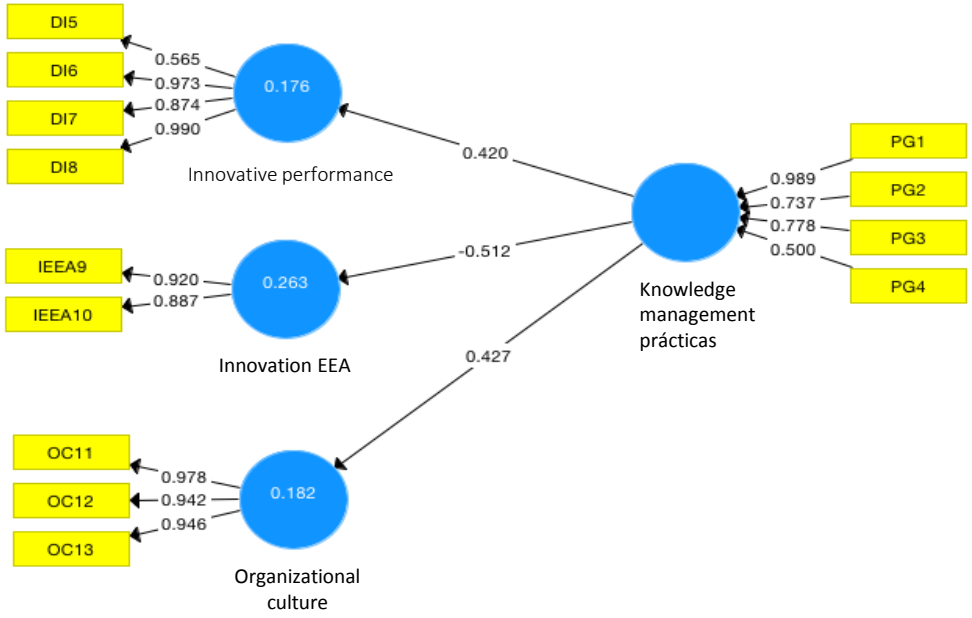
| Discriminant validity | | | | |
|---|---|---|---|---|
| **Component** | **Company-University collaboration** | **Competitiveness** | **Business innovation indicators** | **Prácticas de Gestión del Conocimiento** |
| CE-U14 | 0.729 | 0.481 | 0.355 | 0.561 |
| CE-U15 | 0.516 | 0.275 | 0.290 | 0.263 |
| CE-U16 | 0.791 | 0.790 | 0.509 | 0.435 |
| CE-U17 | 0.671 | 0.698 | 0.885 | 0.412 |
| Cm18 | 0.741 | 0.791 | 0.698 | 0.325 |
| Cm19 | 0.781 | 0.922 | 0.927 | 0.614 |
| Cm20 | 0.685 | 0.889 | 0.571 | 0.682 |
| Cm21 | 0.707 | 0.830 | 0.478 | 0.390 |
| InIE22 | 0.745 | 0.780 | 0.991 | 0.477 |
| InIE23 | 0.678 | 0.714 | 0.945 | 0.446 |
| InIE24 | 0.741 | 0.786 | 0.978 | 0.488 |
| InIE25 | 0.702 | 0.754 | 0.966 | 0.474 |
| PG1 | 0.633 | 0.609 | 0.434 | 0.962 |
| PG2 | 0.477 | 0.503 | 0.463 | 0.815 |
| PG3 | 0.482 | 0.508 | 0.434 | 0.808 |
| PG4 | 0.342 | 0.356 | 0.274 | 0.555 |

**Table 4 Cross-load matrix and divergent validity: External Conditions.**
*Calculations made in SmartPLS3.0.*

# Results Structural model

For the evaluation of the model two basic indices will be used $R^2$ y and standardized path coefficients β.

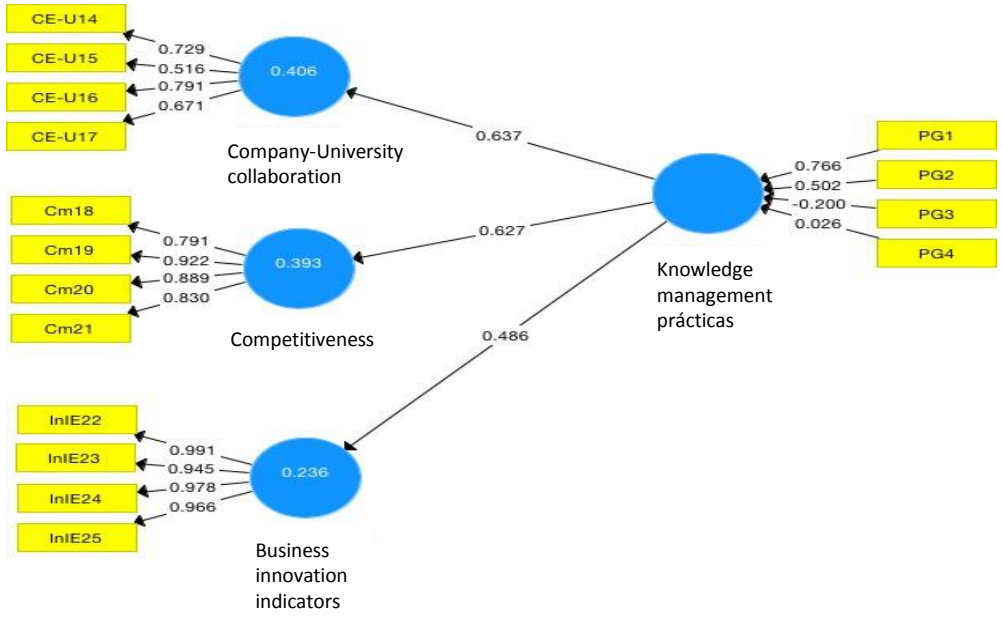
*PLS*




DI5 Implement innovation projects that respect the environment. DI6 Products developed from the follow-up of customer needs. DI7 Opening of national markets. DI18 Increase in customers. IEEA9 Type of Innovation. IEEA10 Innovation management. OC11 Declared culture towards innovation. OC12 Leadership (senior management support). OC13 Applications and tools (software).

**Figure 2 Monogram of the Internal Conditions for the development of innovation capabilities (PLS).**

*Calculations made in SmartPLS3.0.*




CE-U14 Reason for collaboration with the University. CE-U15 Collaboration with the University and the government sector for the development of R + D + i projects. CE-U16 The response of the academy to the demands of consulting, research and innovation in the industrial sector. CE-U17 Knowledge transfer. Cm18 Productivity (annual increase according to goals). Cm19 Innovation strategy Expenditure on R + D + i / Sales). Cm20 Registered Patents. Cm21 Design of a financial plan for the development of innovation activities. InIE22 Training oriented towards the creation of innovation. InIE23 Participation of managers in innovation activities. InIE24 Collaboration networks of which the company is a part to identify opportunities for innovation. InIE25 The possibility of implementing an idea arising from the staff of your company, so that it becomes a product or service that is launched into the market.

**Figure 3 Monogram of the External Conditions for the development of innovation capabilities (PLS).**

*Calculations made in SmartPLS3.0.*

$R^2$ should be greater than or equal to 0.1 (Falk y Miller,1992). Coeficientes *path*, < 0,3 (Chin, 1998).

# Results Structural model

**HE:** There is a positive relationship of predictive and significant interdependence of the variances between variables […] in the structural model for the development of innovation capacities.

| Constructos | $R^2$ | β | Sig. β | |
|---|---|---|---|---|
| Relationship between Innovative Performance and Organization | 0,813 | 0,902 | <0,3 | |
| Relationship between Culture Organization and Innovation EEA | 0,783 | 1,500 | <0,3 | ☑ |
| Relationship between EEA Innovation and Innovative Performance | 0,305 | 0,430 | <0,3 | |
| Relationship between Business Innovation Indicators and Competitiveness | 0,814 | 0,902 | <0,3 | |
| Relationship between Competitiveness and Company-University Collaboration | 0,861 | 0,928 | <0,3 | ☑ |
| Relationship between Business-University Collaboration and Business Innovation Indicators | 0,852 | 0,923 | <0,3 | |
| PG-DI | 0,186 | 0, 432 | <0,3 | ☑ |
| PG-IEEA | 0,254 | -0,504 | <-0,5 | ☑ |
| PG-CO | 0,355 | 0, 596 | <0,3 | ☑ |
| PG-CE-U | 0,431 | 0, 657 | <0,3 | ☑ |
| PG-Cm | 0,492 | 0, 701 | <0,3 | ☑ |
| PG-InIE | 0,233 | 0,483 | <0,3 | ☑ |

$R^2$ Should be greater than or equal to 0.1 (Falk and Miller, 1992). Path coefficients, <0.3 (Chin, 1998).

# Conclusions

| 01 | 02 | 03 | 04 |
|---|---|---|---|
| **Model Structural Equations** | **Internal conditions** | **External conditions** | **Result the proposal of a Contextualized Model** |
| **General** | **There is a positive statistical relationship at a moderate level** | **There is a positive and significant statistical relationship at a high to moderate level** | **Knowledge management model to develop innovation capabilities (Villalobos, 2015: 221).** |
| The model based on structural equations denotes that there is a predictive and positive relationship in the deployment of processes that impact knowledge management and business innovation. | Individual and organizational knowledge is mobilized to create innovative processes, services or products that will mark a differentiating advantage for the organization from its competitors. | Companies take advantage of the opportunities of the environment through collaboration or linking (competitors, customers, markets, society, government, university, business affiliations) to appropriate information and knowledge, and transform it into products, services or processes that allow them to survive and compete in dynamic and complex contexts. | In framed on the scientific and technological models of knowledge management: whose purpose is the management of technological innovation and its purpose is to promote research and development within public or private organizations (Barragán, 2009: 75).<br><br>It is based on the knowledge management practices that are developed in three dimensions; organization, R + D + i and the environment, hat interact and feed back according to the predictive results shown in the monograms. |

# Bibliography


Alonzo, M. D. L. Á. V., & González, A. E. R. (2015). Diseño y validación de cuestionario para la exploración de capacidades de innovación para empresas de alta tecnología de México. Revista QUID, (25).

Barragán Ocaña, A. (2009). Aproximación a una taxonomía de modelos de gestión del conocimiento. Intangible Capital, vol. 5, núm. 1, p. 65-101.

Cepeda, G. y Roldan, J. L. (2007). Aplicando en la práctica la técnica PLS en la administración de empresas. Departamento de Administración de Empresas y Comercialización e Investigación de Mercados, Facultad de Ciencias Económicas y Empresariales Universidad de Sevilla España.

Chin, W. W. (1998). The partial least squares approach to structural equation modeling. Modern methods for business research, 295(2), 295-336.

Fleiss, J.L. (1981). Statistical methods for rates and proportions. New York: John Wiley and Sons.

Falk, R.F. y Miller; N.B. (1992). A Primer for Soft Modeling. Akron, Ohio: The University of Akron.

Fornell, C. (1982). A Second Generation of Multivariate Analysis: An Overview. New York: Praeger Publishers.

Kerlinger, F.N. y Lee, H.B. (2002) Investigación del Comportamiento: Métodos de Investigación en: ciencias sociales, México: McGraw-Hill Interamericana Editores.

Nunnally, J. C. (1978). Psychometric theory. New York: McGraw-Hill.

Phares, E.J. y Trull, J. T. (2003) Psicología clínica: Conceptos,  métodos y aspectos prácticos de la profesión. EDICIONES PARANINFO.

Villalobos, A. M. A. Modelo de gestión del conocimiento para el desarrollo de Capacidades de Innovación en el sector indusctrial de alta tecnología en México. (2015). Tesis Doctoral. Universidad Popular Autónoma del Estado de Puebla. UPAEP. México.

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