

# A MODEL FOR THE CREATION OF KNOWLEDGE AND COMPETITIVE SUSTAINABLE ADVANTAGES IN THE SUPPLY CHAIN

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## KEYWORDS

Efficient consumer response, logistic operators, structural equations model, SEM.

## ABSTRACT

This paper presents a model to measure the knowledge and sustainable competitive advantages generated by logistic operators, within the Efficient Consumer Response (ECR) framework. We present a definition of ECR practices, propose a model to measure the effects of these practices on final firm's results and develop a validation of the methodology, meeting the demands of related companies and logistic operators. The paper is part of a more general study trying to test the model on three groups of partners: firms operating with ECR practices, business consultants and researchers. The previous results allow us to conclude that logistic operators perceive these practices as relevant ones. The best valued items by the logistic operators are: human capital, improvement on individual labor and group climate, and improvement in learning and training firms plan.

## INTRODUCTION

ECR is a joint strategy of suppliers and distributors to offer consumers highest value, best service and greatest variety of products; outcome of the collaboration on supply chain improvement and demand generation (Ferrer & Del Castillo (1996), Stern, El-Ansary & Hayes (1998), Whipple, Frankel and Anselmi (1999) AECOC, PROMARCA, 2000). A number of authors have stressed several necessary elements for ECR practices implementation success: key is the relationship amongst manufacturers and distributors (Merrefield, 1993), that demands changes in the firm's structure and processes (Shulman, 1993) and investment on information technologies. ECR processes must not be implemented distant from the creativity in merchandising and the firm's promotional activity (Veiders, 1993). ECR practices are strongly applied in the grocery industry, executive Information Systems

(EIS), Electronic Data Interchange (EDI) and Radio derived devices (Buddembaum, 1994). Efficiency, flexibility and customer orientation are the main principles that manage the joint action of all the members in the supply chain in order to achieve the intended objective (Mejías, García, Prado, 2001). The adoption of practices in the ECR initiatives can introduce a change in various organization activities. Amposen (1991), Davenport (1998), Nonaka (2000), Ciborra and Andreu (2001) and Prusak (2002), amongst others, explain the change and learning experiences through the knowledge generation and management. To measure the ECR initiative impact on sustainable competitive advantages generation, we have drawn on the Technology Strategy Generic Actions (ITSGA) Information methodology (Andreu, Ricart and Valor, 1997). Other authors have recently paid attention to this methodology: to incorporate into the firm's strategic objectives the experiences of other firms and the possibilities offered by information and communication technologies, to achieve competitive advantages (Palou, 2006), on strategic planning (Holistic consulting), for value chain redesign by paying special attention to the synergies amongst different processes (Soto and Tapia, 2006) and in the planning strategy derived from information technologies and information systems (IT/IS) (Gil and Guarch, 2006).

## THE MODEL: OBJECTIVE AND HYPOTHESES

In this study we propose a model for the measure of knowledge and competitive advantages generation in the "Efficient Consumer response practices" (ECR) area. This implies the identification, selection, and validation of intellectual capital and its competitive advantages indexes (that we have named "associated concepts"), the study of enablers and promoters in the implementation and the revealing of critical success factors. The measurement model is composed of two blocks: knowledge and competitive advantages. We have revisited the ongoing models, see references, and the Intellect Euroforum model has been the basis of our analysis. It is easy to understand and according to

Bueno, Rodríguez and Salmador (2003): open, flexible and universal. Many important firms in Spain have applied this model (among others PriceWaterhouse Coopers, Telefonica R+D, Inditex Group and the Public Administration). To measure the impact of the ECR practices in sustainable competitive advantages (SCA) we made use of the methodology for strategic planning ITSGA. It tries to identify “strategic generic actions” that can promote sustainable competitive advantages. Firms as Sears, Federal Express or TRW have identified a group of ITSGA categories for strategic applications as e.g.: transactions with customers, new products development and establishment of a group of collaboration agreements. Besides, some authors as de Pablos *et al.* (2006) and consultants’ groups have considered and applied this methodology for standard actions identification. Combining the mentioned tools, we propose our model for the intellectual capital measurement composed of three parts: human capital (HC), structural capital (SC) and relational capital (RC). To measure the sustainable competitive advantages (SCA) we propose 5 categories: “product”, “customers”, “channels”, “providers” and “general”. By analogy, we name the second SCA block ECRSGA (strategic generic actions based on ECR practices). Each of these 8 blocks (3 of Intellectual Capital (IC) and 5 of ECRSGA) is divided into 41 elements, items in the survey. That will help us to validate the model. At the same time, each item presents a group of non exclusive alternative answers. All this means 176 variables, measured via “perceptions of improvement” based on a Likert scale.

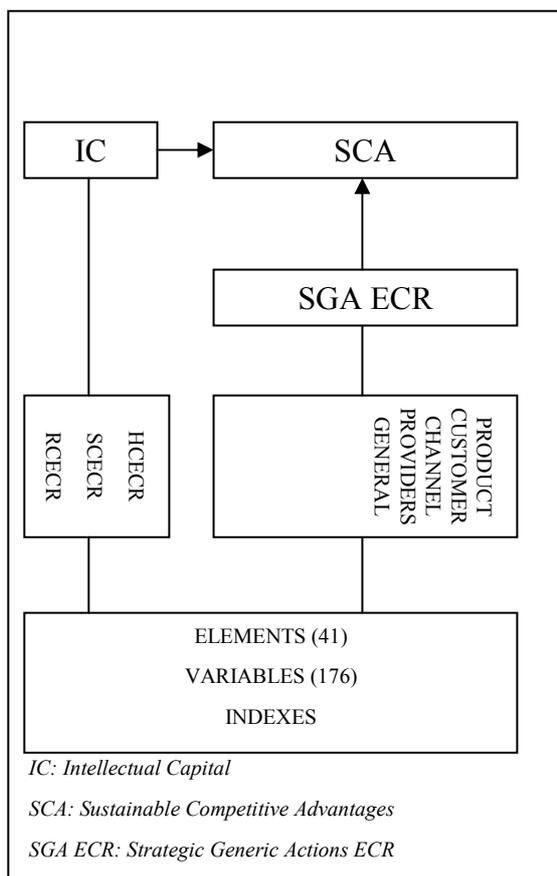


Figure 1 - Model for IC, SCA in the ECR practices measurement (Soret, 2007)

According to the literature review (see introduction), we have selected a group of variables to include in the model; allowing us to measure the impact of ERP initiatives in final firm’s results.

Model variables. Source: Intelec Model (Bueno <i>et al.</i> , 2003)
<b>Human capital measurement</b> Improvement of individual and work conditions Managerial style Learning improvement Education-training Organizational environment Integration of people in the firm Promotion, rewards <b>Structural capital measurement</b> Data mining techniques Procedures manual Improvement of processes Communities of practices <b>Relational capital measurement</b> Customer standards Customer satisfaction Loyalty programs CRP, CPFR techniques ASN techniques
<b>Sustainable Competitive Advantages measurement</b> Source: Andreu <i>et al.</i> (1997), Andreu and Sieber (2000) Improvement of information to SC and consumers Improvement of the communication offered to the SC Degree of personalization of the product to providers Information on new products Innovation and price to final customers

Figure 2: Model variables

This way, considering the eight defined blocks, we propose the following hypotheses:

H01	ECR initiative generates and/or increases firm’s the human capital
H02	ECR initiative generates and/or increases firm’s relational capital
H03	ECR initiative generates and/or increases firm’s structural capital
H04	Knowledge reached by the adoption of ECR practices generates sustainable competitive advantages related with the product
H05	Knowledge reached by the adoption of ECR practices generates sustainable competitive advantages related with the product
H06	Knowledge reached by the adoption of ECR practices generates sustainable competitive advantages related with the distribution channels
H07	Knowledge reached by the adoption of ECR

	practices generates sustainable competitive advantages related with the providers
H08	Knowledge reached by the adoption of ECR practices generates sustainable competitive advantages related with the firm's general aspects

Figure 3 : Hypotheses

The three (basic) first hypotheses are part of the general hypothesis (theoretical hypothesis): the ECR initiative generates or increases the human, structural and relational capitals. Increasing, therefore, the firms' intellectual capital. The same way, the rest of the "basic" hypotheses are part of another "theoretical" general: the knowledge generated by adoption of ECR practices generates sustainable competitive advantages, related with a group of categories. To sum up, we are trying using a confirmatory analysis, to find out if the generation and/or increase of intellectual capital promotes sustainable competitive advantages in the ECR initiative.

The 176 variables and indexes for the perception increase are divided into nine different blocks: block I is composed by human capital indexes, block II by structural capital indexes, block III by relational capital indexes, from block IV up to block VIII, different indexes for sustainable competitive advantages are shown. Block IX refers to the study of what we have named "associated concepts", as enablers in the implementation and critical success factors and is not part of the former confirmatory analysis.

### THE ANALYSIS METHODOLOGY

In order to obtain information, 15 interviews were carried on with experts in a group of firms<sup>1</sup> that operate ECR initiatives. Amongst them, we formed an eight experts panel. By group dynamics work, and a previous deep interview with each member, we agreed on the main structure for the general model. With the help of another panel of experts in market research, we elaborated the final questionnaire. For obtaining the data from the sample, and on an attempt to increase the number of respondents, we organized a professional seminar in ESIC (Business and Marketing School), Madrid, with researchers of the Rey Juan Carlos University and the collaboration of LOGICA, the Spanish organization grouping logistic operators. The seminar call was announced as follows: in the economic press during 4 days, an e-mail was sent to 2.500 potential participants, information on radio during a whole week and in the web page [www.eriete.com](http://www.eriete.com). From the seminar, we got 65 completed surveys. After that we still got 27 via personal interview. The data have been processed using SPSS and AMOS.

The factorial analysis reveals some dimensions for the different blocks in the model that will be used as measurable variables in a model of structural equations, SEM, containing latent variables and measurement

errors. The general model for the structural equations systems is a formal mathematical model, a group of linear equations that include variables that can be directly observed and measured and latent variables that represent concepts that cannot be directly observed. Our model of measurement for IC and SCA adapts perfectly to the structure of a lineal structural equations model. Composed by two sub-models: the structural model, that relates among them the latent variables(HC, SC, RC and SCA); and the measurement model, that relates each latent variable with the variables measuring it in a direct way (the indexes). The model establishes that there is a direct relationship of the three capitals with the SCA generation and a certain relationship amongst those capitals. Besides, the measurement errors are explicitly included for each variable in the process of estimation.

To check the results we carried out a Bayesian estimation. The sample was generated, 10 complete groups of data, by the Markov Chain Monte Carlo method, MCMC, with a diffuse distribution as *a priori*. This way, we were able to obtain a sample of 900 data, enough for the estimation.

### MAIN RESULTS

The variables have been grouped into 28 factors: 8 for HC, 4 for SC, 10 for RC and 6 for SCA. Each dimension groups various elements in the obtained factor structure. These dimensions or factors will be the used as measurable variables in the model of structural linear equations.

We have obtained a global satisfactory adjustment of the structural equation model. The results for each latent variable with their factors, the regression standardized weights and their correspondent p-values, are presented in figure 4.

HUMAN CAPITAL	(Estimation, p)
Improvement of individual and work conditions	(0'654, 0'000)
Managerial style	(0'596, 0'000)
Learning improvement	(0'465, 0'000)
Education-training	(0'415, 0'000)
Organisational environment	(0'158, 0'000)
Integration of people in the firm	(-0'233, 0'000)
Promotion, Rewards	
STRUCTURAL CAPITAL	
Data mining	(0'545, 0'000)
Procedures manual	(0'200, 0'000)
Improvement of processes	(0'065, 0'049)
Communities of practice and virtual university	(-0'269, 0'000)

RELATIONAL CAPITAL	(Estimation,p)
Customer standards	(0'862, 0'000)
Customers satisfaction	(0'182, 0'000)
GXC	(0'100, 0'002)
Loyalty programs	(-0'272,0'000)
CRP, CPFR ASN	(-0'155,0'000)
<b>SUSTAINABLE COMPETITIVE ADVANTAGES</b>	
Improvement of information to SC and consumers	(0'725, 0'000)
Improvement of communication to SC	(0'224, 0'000)
Personalisation of the product to providers	(0'134, 0'000)
Information on new products	(-0'214,0'000)
Innovation and price to final customers	(-0'179,0'000)

Figure 4 - Standard weights of the model variables and p-value

In relation with the previous results and with the group of basic hypotheses 1,2 and 3 -those relating to the adoption of practices in the ECR initiative, the generation or increase of the human, structural and relational capital in the organisations- there exists a direct relationship amongst the following variables: individual improvement and work conditions, managerial style, improvement of learning skills, training, the management by objectives and the work environment. All have a direct impact in the increase of HC.

The increase of SC can be obtained by the adoption of data mining techniques, generation of manuals establishing procedures and continuous process improvement.

The increase of RC is directly related with the creation and/or improvement of the standards for customers, their satisfaction, and the management by categories and the loyalty programmes.

Concerning to the group of basic hypotheses 4 to 7 -that is with firms that relate the increase of intellectual capital with the generation of sustainable competitive advantages (SCA)- there is a direct relationship amongst the following variables: the improvement of information to the supply chain and to the consumer, the improvement of the communication to the supply chain and the personalisation of the product to providers.

The theoretical hypothesis 1 and 2 have been verified. This means that ECR is a technique for individual and organisational learning, and the creation of knowledge and this generates sustainable competitive advantages for firms and organisations in the area of efficient consumer response, ECR.

Or, in other words, ECR improves the organisational results by the creation of SCA.

		Estimation	P
Structural Capital	<--- Human Capital	,024	***
Relational Capital	<--- Human Capital	-,332	***
Relational Capital	<--- Structural Capital	3,336	***
Competitive Advantages	<--- Human Capital	,041	,009
Competitive Advantages	<--- Relational Capital	,184	***
Competitive Advantages	<--- Structural Capital	,582	,002
FACTOR1CE	<--- Structural Capital	1,000	
FACTOR2CE	<--- Structural Capital	-,990	***
FACTOR3CE	<--- Structural Capital	3,155	***
FACTOR4CE	<--- Structural Capital	,352	,049
FACTOR8CH	<--- Human Capital	-,051	,016
FACTOR7CH	<--- Human Capital	,447	***
FACTOR6CH	<--- Human Capital	-,041	,071
FACTOR5CH	<--- Human Capital	,118	***
FACTOR4CH	<--- Human Capital	,184	***
FACTOR3CH	<--- Human Capital	-,111	***
FACTOR2CH	<--- Human Capital	,515	***
FACTOR1CH	<--- Human Capital	1,000	
FACTOR8CR	<--- Relational Capital	,016	,460
FACTOR7CR	<--- Relational Capital	-,150	***
FACTOR6CR	<--- Relational Capital	-,002	,948
FACTOR5CR	<--- Relational Capital	-,007	,834
FACTOR4CR	<--- Relational Capital	,100	***
FACTOR3CR	<--- Relational Capital	-,259	***
FACTOR2CR	<--- Relational Capital	1,000	
FACTOR1CR	<--- Relational Capital	-,099	***
FACTOR1VCS	<--- Competitive Advantages	1,000	
FACTOR2VCS	<--- Competitive Advantages	-,272	***
FACTOR3VCS	<--- Competitive	,109	***

			Estimation	P
		Advantages		
FACTOR4VCS	<---	Competitive Advantages	-,256	***
FACTOR5VCS	<---	Competitive Advantages	,111	***
FACTOR9CR	<---	Relational Capital	-,033	,158
FACTOR10CR	<---	Relational Capital	,085	,002
FACTOR6VCS	<---	Competitive Advantages	,132	***

Figure 5 - Structural equations model

We present some conclusions derived from the global adjustment of the structural equations model

## CONCLUSIONS

The results seem quite interesting ones. All the coefficients that interconnect the variables of interest, the different capitals considered and the sustainable competitive advantages are positive and besides with p-values lower than 0,001.

For the human capital the highest valued items by the logistic operators are: the improvement in the individual and group labor climate (FAC3\_2 = 31,631) and the improvement in learning (FAC4\_3=31,874) and training classes in the named "associates concepts". For the structural capital, the improvement in the process efficiency, the improvement in the customer systems (Data Warehouse) and the improvement in organizational systems. For the relational capital, the participation in ECR practices in general and in CRP, KFA, DRO (continuous replenishment, key file alignments, delivery and reception orders) in particular. For the sustainable competitive advantages: the communication agreements in the distribution, the personalization of the product and the improvement in the portfolio and promotions for customers.

The intellectual, human, structural and relational capitals have a direct and positive influence in generation of sustainable competitive advantage. We can also appreciate that there is a positive relationship amongst the different capitals considered: in the structural capital, the biggest impact on the increase is produced through the human capital and the relational capital increases, because the human and structural capitals. It seems that the generation of knowledge can provide to firms the achievement of sustainable competitive advantages.

The previous results in the structural equation model, joint to the descriptive analysis, allow us to conclude that, probably and in a significant way, the logistic operators perceive some practices as relevant ones. The best valued items by the logistic operators are: human capital, improvement in the individual labor and group

climate, improvement in the learning and training classes in the "associated concepts". By focusing in the structural capital, the most important relationships are in the improvement in the efficiency in processes, the improvement in systems to improve the relationship with customers (Data warehouse) and the improvement in organizational systems. For the relational capital, the participation in ECR practices in general and in CRP, KFA, DRO (continuous replenishment, key file alignments, delivery and reception orders) in particular. For the sustainable competitive advantages part: the communication agreements in the distribution, the product personalization and the improvement in the portfolio and customer promotions.

However, we think it is important to go deeper in the factors that do not allow a satisfactory fit for the particular case of the logistic operators. That it is the reason why, we must wait for further conclusions until our research allow us to obtain better results. Amongst the most important barriers we have found in our analysis, we have to stress the size of the sample used. The structural equations models requires of a wider sample. We have tried to solve this problem by applying the Markov Chain Montecarlo methodology; apart from this, firms are quite reluctant to offer some data needed for the qualitative research. For these reasons, we suggest as future research to keep on developing deep interviews with the people responsible, in the firms, of the areas of our interest, so that this can offer us to clear son cause-effect relationships, and go deeper on the study of the best industry practices and, specially in the ones we have been unable to find a definitive conclusion.

## REFERENCES

- Accenture; Ecr-España. 2002. "Proyecto de indicadores ECR, edición año 2002", Barcelona
- AECOC. 1998. "Información básica EDI", AECOC, Barcelona.
- Aecoc. 1999. "Congreso AECOC'99, Barcelona.
- Aecoc. 2000. "Sistema de medida de evolución de indicadores de gestión", AECOC, Barcelona.
- Aecoc 2001. "ECR España Scorecard (Proyecto indicadores ECR 2000), Documento interno de trabajo, también en www.aecoc.es.
- Aecoc 2005. "Memoria anual 2005, AECOC, Barcelona.
- Afifi, A. A. and Clark, V. 1990. "Computer-aided multivariate análisis", Chapman & Hall, Nueva York.
- Amponsem, H. 1991. "Organizational Learning through Internal Systems, Strategic Alliances and Networks", Tesis doctoral, Queen's University at Kingston, Canadá.
- Anadif (Asociación Española De Empresas De Almacenaje y Distribución Física); Deloitte & Touche 2003. "Análisis sectorial sobre el mercado de los operadores logísticos en España", documentación interna.

- Andreu, R.; Ricart, J. E. and Valor, J. 1997. "La organización en la era de la información", McGraw-Hill, Madrid.
- Andreu, R. and Sieber, S. 2000. "La gestión integral del conocimiento y del aprendizaje", Economía industrial, nº 326, pp. 63-72.
- Armstrong & Associates, INC. 2002. Informes, también en [www.3plogistic.com](http://www.3plogistic.com)
- Brooking, A. 1996. "Intellectual capital: core assets for the third millennium enterprise", Thomson Business Press, Londres.
- Buddenbaum, S. 1994. "Spurred by ECR, retailers see tech solutions", U.S. Distribution Journal.
- Bueno, E.; Rodríguez, O and Salmador, M. P. 2003. "La importancia del capital social en la sociedad del conocimiento: propuesta de un modelo integrador de capital intelectual", I Congreso Internacional y Virtual de Intangibles.
- Ciborra, C. U. and Andreu, R. 2001. "Sharing knowledge across boundaries", Journal of Information Technology, nº 16, pp 73-81.
- Davenport, T. H. and Glaser, J. 2002. "Just in time delivery comes to knowledge management", Harvard Business Review, Julio, pp. 5-9.
- De Pablos, C. ; López-Hermoso, J. J. ; Martín-Romo, S. ; Medina, S. ; Montero, A. and Nájera, J. J. 2001-2006. "Dirección y gestión de los sistemas de información en la empresa", Universidad Rey Juan Carlos – Servicio de publicaciones y ESIC Editorial, Madrid.
- Ferrer, J. and del Castillo, G. 1996. "ECR, primeras acciones en España", Código 84, mayo/junio, nº 54.
- Gil, I. and Guarch, J. J. 2006. "PE – Planificación estratégica de TI/SI", [www.personales.upv.es/igil/lío.pdf](http://www.personales.upv.es/igil/lío.pdf)
- Hayes, J. 1998. "ECR: win customers with better, smaller choices", Fourth Annual Efficient Response Conference. Mailer-Daemon@email-delivery.galegroup.com
- Jöreskog, K. G. 1993. "Modelado de ecuaciones estructurales", Euskadiko, Guipúzcoa.
- Kurt Salmon Associates, INC. 1993. "Efficient Consumer Response: Enhancing consumer value in the grocery industry", Washington, DC: Food Marketing Institute.
- Lógica, Organización Empresarial De Operadores Logísticos. 2005. "Análisis sectorial sobre el mercado de los Operadores Logísticos en España", Madrid.
- Mejías, A.; García, J. and Prado, J. C. 2001. "Tecnología y mejores prácticas como factores facilitadores para la gestión de la cadena de suministro", XI Congreso Nacional de ACEDE, Zaragoza.
- Merrefield, D. 1993. "A new art. Modifying business practices under ECR, Supermarket news. Mailer-Daemon@email-delivery.galegroup.com.
- Nonaka, I. 2000. "La empresa creadora de conocimiento", Harvard Business Review: Gestión del conocimiento, Deusto, Bilbao, pp. 23-49.
- Ordóñez de Pablos, P. 2000. "Herramientas estratégicas para medir el capital intelectual organizativo", Revista de estudios empresariales, nº 102, Junio, Universidad de Deusto, pp. 36-42.
- Ordóñez de Pablos, P. 2002. "Gestión del conocimiento y capital intelectual: evidencias empíricas en Europa", XI Congreso Nacional de ACEDE.
- Palou, C 2006. "Soluciones llave en mano: respuesta integral a todas las necesidades", 1º taller nacional de tecnologías aplicadas al sector hotelero: 20 casos de éxito, 20 soluciones reales", Informática El Corte Inglés, en [www.fundetec.es](http://www.fundetec.es)
- Prusak, L. 1998. "Presentation to the conference board", Conference on knowledge management and organizational learning, April, Chicago.
- Soret, I. 2008. "Modelo de medición de conocimiento y generación de ventajas competitivas sostenibles en el ámbito de la iniciativa Respuesta Eficiente al Consumidor", ESIC Editorial, Madrid.
- Soto, J. L. and Tapia, D. 2006. "Planificación estratégica de TI / SI", [www.bibliotecna.upc.es](http://www.bibliotecna.upc.es)
- Shulman, R. 1993. "Will the ECR Repport evoke effective corporate responses", Supermarket Business. Mailer-Daemon@email-delivery.galegroup.com.
- Stern, L.; El-Ansary, A.; Curghlan, A. and Cruz, I. 1999. "Canales de comercialización" (5ª edición), Prentice Hall, Madrid. Mailer-Daemon@email-delivery.galegroup.com
- Veiders, Ch. 1993. "Panel sees unique ECR challenges" (Food Marketing Institute Conference), Supermarket news. Mailer-Daemon@email-delivery.galegroup.com.
- Whipple, J.; Frankel, R. and Anselmi, K. 1999. "The effect of governance structure on performance: A case study of efficient consumer response", Journal of Business Logistics, vol. 20, nº 2, pp. 43-62.

<sup>1</sup> The analysed firms show their desire for being not mentioned by considering of strategic importance the provided information

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