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## The adoption of communication and information technologies and the local development in Côa' Region

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# **THE ADOPTION OF COMMUNICATION AND INFORMATION TECHNOLOGIES AND THE LOCAL DEVELOPMENT IN CÔA' REGION**

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## **ABSTRACT**

This paper examines the imbalances in the availability and usage of communication and information technology infrastructure in the Côa' Region. Based on an empirical study, the imbalances could be broadly attributed to differences in funding, management and technical expertise, exposure and awareness to available technologies, training, and other infrastructures like R&D laboratories/institutes and universities. In the organisations studied, the imbalances could be broadly attributed to differences factors as industry, dimension, management education, but also to lack of cooperation, workers mobility and reduced markets witch are common factors in disfavoured regions.

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## **1. INTRODUCTION**

Since the 80 years the European Union and national states began to realise the importance of information and knowledge as valuable resources, both nationally and within organisations, especially in rural and disfavoured areas.

These efforts lead to the development of National Information and Communication Infrastructure (NICI) policies, plans and strategies that could be used to enhance the role of information and communication technologies (ICTs) in facilitating the socio-economic development process.

The new information and communication technologies are of key importance to the inhabitants of the regions, as the Committee of the Regions underlined in its opinion on measures to promote information and communication technologies. Not only is there a significant digital divide between European Union countries, but also within these countries many regions are entirely 'off the grid' (Persaud, 2001; Kowalczykowski, 2002).

The use of information technologies is helping to strengthen economic and social cohesion. It is also improving the economic competitiveness of the regions. However the territory development process depends of the decisions of governance system and of others economics actors. It results of the historic process accumulation of attitudes and decisions and experience.

Regions situated far from large cities and densely populated urban areas are now, thanks to the ICT, able to gain access to the same up-to-date information as is available in urban areas.

Information and Communications Technology (ICT) is an increasingly powerful tool for participating in global markets; promoting political accountability; improving the delivery of basic services; and enhancing local development opportunities. Innovation is a key for the sustainable development, competitiveness and depends on the access to the tacit and codified information and knowledge being ICT a way to contribute to easier access.

According to Neto and Barroso (2003) the relationship between the adoption of the Information Communication Technologies (ICT) in the companies and the regional development represent one potential form that permits regional territories to project and position itself and favour the emergence of new organizations and relationships configurations. In an increased information society ICT constitute a regional development instrument through information flows developed.

In the recent decades EU and national states have planned policies to introduce ICT in rural areas in order to permit access to new and distant markets, to break isolation and increase competitiveness. The adoption of ICT by the companies reflects the power of the regional policies adopted. In order to successfully implement policies, factors such as the organizational, institutional and socio-cultural environment of the regions and rural enterprises should be taken under consideration (Georgoudaki,E.; Dimara, E; Skuras, D.; 2003, p.1)

According to OECD (2001), Neto (2002), (Georgoudaki, et al. 2003) it is frequently believed that ICTs offers new means for revitalization of rural economies that for a long period have been under a severe economic decline and experienced outward urban migration. The increased access to information and the opportunity provided to rural and remote companies to serve new markets by diminishing the impact of distance and time were the main benefits. In this view, the ICT are one instrument for company's development and for local development.

Our understanding of ICT infrastructure relates to the view of Lyytinen (1991), according to which information and communication technology comprises of computing and telecommunication technologies and is associated to the know-how applied in different fields or organisational activity.

Simultaneously, the small and medium companies (SME's) assume an important role in the regional and local economy. The SME's are more flexible in adopting the new technologies and accord to Julien (1995) some regions are developed based in the SME's, where the employment, the added value and the exportations increased in the occidental economies. According to Vaz and Cesário (2003) the SME's contributed to the middle actives and dynamics through networks relationships with others companies.

The importance of the SME's on local development, particularly in peripheral regions is also evident in the work of Nicolas and Noronha (2000), Georgoudaki, et. al (2003); Vaz and Cesário (2003).

Norris (2001) is one of the researchers who has focused on the economic and political aspects of availability and usage of communication and information technology infrastructure, and has distinguished three hierarchical levels: the macro-level, the technological and economic resources available and their distribution, the meso-level, the role played by political institutions, and the micro-level, individual resources and individual motivation.

Thus, the aim of this paper is to present the results of an empirical research from the companies of the Côa' Region, that is located in the interior of Central Portugal and that relates the implementation and utilization of ICT and their impact in the local dynamic of innovation and propose a analytical framework for the following goals: to generate local innovation and competitiveness using the ICT in SME's.

## **2. HYPOTHESES AND METHODOLOGY**

In this paper we tried to analyse the situation of companies in Côa' Region in terms of innovations introduction and verify which conditions can generate more dynamism. For this purpose we considered the following factors, based on the third level presented by Norris (2001): (1) activity sector; (2) number of employers; (3) company dimension; sales volume; (4) year of establishment; (5) export activity; (6) management education; (7) customer/supplier relationship systems.

With the first factor we consider the fact that industry dynamics can moderate the innovation process; the second and third factor measure the dimension as an moderator as well; the fourth factor introduces the question of maturation process; the fifth factor measures the involvement in foreign markets as a driver for innovation; the sixth factor is managerial influence in this process, namely academic education and the seventh factor tries to include prior development of ICT's as a moderator to more innovation investment.

The C  a is a poor region in Portuguese and European terms in which a series of elements: scarce technological base, reduced company size, a poor managerial attitude towards modernization and reluctant cooperation between companies universities and investigations centres. Those characteristics limit de creation and diffusion of innovation and competitiveness develop. This region covers part of two sub-regions and is constituted by eight councils of “Beira Interior Norte” and one of “Douro”.

According to Stake (1998), the most unique aspect of a case study is the selection of cases to study. It was recognised that understanding of the phenomena depends on the appropriate choice of the cases. The study uses as methods of data gathering surveys with quantified responses that allows analysing the performance of the companies of this region relatively to the use of ICT. The sample we used for survey was based on a set of companies of the Portuguese Base of Establishments and Companies from the Portuguese National Institute of Statistics. The inquiries were directed to the managers personally by postal shipping and by e-mail. The information was recollected the months January, February, March and April of 2003. In selecting the sample we considered all companies that had more than 10 employees.

### 3. DATA TREATMENT AND RESULTS

In order to verify our hypothesis we began to group the companies using cluster analyses with the aim of verifying the different level of innovation present. We obtained three groups: the first, constituted by companies we higher innovation established; a second with more limited innovations centred in marketing and a third with an intermediate level of innovations.

**Table 1- Cluster Analysis**

	Clusters		
	1	2	3
New products lines	3	2	2
New markets/increased market share	3	2	2
Procut quality improvement	3	2	3
Increased operational flexibility	3	0	2
Increased Production capacity	3	0	2
Labour cost reduction	2	0	1
Energy and Material reduction	1	0	0
Security and environment improvement	2	0	2
Compliance with norms and regulations	3	0	2
Other innovations	0	0	0

Based on the statistics in table 2 we can verify that these different levels of innovation can significantly separate the companies studied and that the only variable that does not as significance is the new markets and increased market share type of innovation.

**Table 2 – Cluster Analysis Anova**

	Cluster		Error		F	Sig.
	Square	df	Square	df		
New products lines	3,81	2	1,31	27	2,91	0,07
New markets/increased market share	2,38	2	1,42	27	1,69	0,20
Procut quality improvement	3,92	2	1,04	27	3,78	0,04
Increased operational flexibility	17,96	2	0,67	27	27,01	0,00
Increased Production capacity	18,12	2	0,71	27	25,45	0,00
Labour cost reduction	11,82	2	0,61	27	19,32	0,00
Energy and Material reduction	3,11	2	0,39	27	8,02	0,00
Security and environment improvement	15,34	2	0,77	27	20,03	0,00
Compliance with norms and regulations	19,96	2	0,65	27	30,88	0,00
Other innovations	0,39	2	0,59	27	0,66	0,53

Based in this clustering we analysed our hypothesis by applying discriminate analysis. In table 3 we can verify the results obtained. Two functions were estimated the first explaining 93,2% of variance and the second 6,7%. By observing the Wilks' Lambda test we can verify that the first function is significant, but not the second.

**Table 3 - Discriminat Analysis Functions and Wilks Lambda**

Function	Eigenvalue	% of Variance	Cumulative %	Canonical Correlation
1	2,822	93,216	93,216	0,859
2	0,205	6,784	100,000	0,413

First 2 canonical discriminant functions were used in the analysis.

Wilks' Lambda				
Test of Func	Wilks' Lambda	Chi-square	df	Sig.
1 through 2	0,217	48,879	14,000	0,000
2	0,830	5,977	6,000	0,426

In table 4 we can see that this first discriminant function is related to the activity sector of the company, the dimension of the company and the managerial academic education. The other factor show associated with the second function that as not proven significance and include the year of establishment, the export activity and the use of customer or supplier relationship systems. Based in a process of cross validation we can verify that the probability of correct classification is significantly higher than random probability.

**Table 4 – Discriminant Analysis Structure Matrix**

Functions	1	2
Sectors	0,40	-0,17
Manager education	-0,20	-0,02
Sales Volume	0,15	0,00
Customer/Suppliers relationship systems	0,04	0,76
Export activity	-0,10	-0,30
Company Dimension	0,16	0,25
Year of Instalation	0,10	0,21
63,3% of original grouped cases correctly classified.		
60,0% of cross-validated grouped cases correctly classified.		

We considered another sets of variables, namely the type of cooperation relationships. In table 5 we can observe that companies in group one are significantly different from companies in groups 2 and 3 regarding the cooperation with clients and consultants, while the reverse is true in terms of cooperation with public administration and other institutions.

**Table – 5 Anova – Cooperation**

	F	Sig.	Clusters			Dif. Clusters
			n=7	n=13	n=10	
Affiliated Company	0,98	0,39	1,67	0,88	0,88	
Suppliers	1,08	0,35	2	1	1,13	
Clients	2,63	0,09	2	0,63	0,75	1>2,3
Competitors	0,45	0,64	1,33	0,88	0,88	
Consultants	2,17	0,13	1,67	0,5	0,75	1>2,3
R&D institutions	1,59	0,22	1	0,63	1,5	
Universities	0,56	0,58	1	0,63	1,13	
Development associations	1,20	0,31	0,67	0,5	1,13	
Management associations	0,73	0,49	0,67	1,38	1,38	
Public Adminstration	3,66	0,04	0	0,25	1,13	3>1,2
Local Administration	1,37	0,27	1	0,38	1,13	
Unions	2,53	0,09	0	0	0,5	
Other institutions	2,78	0,08	1	0,38	1,5	3>2



Another aspect we considered was the determination of these companies' principal sources of innovation information and the principal factors that limit innovation implementation. For this we used principal components through factor analysis. In table 6a we can see that in the case of information sources for innovation we four components were identified, explaining 71% of the variance and with a KMO of 0.67.

**Table 6a – Rotated Solution – Information Sources**

Components	Initial Eigenvalues			Rotation Sums of Squared Loadings		
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	4,54	37,81	37,81	2,98	24,85	24,85
2	1,65	13,74	51,55	2,02	16,86	41,71
3	1,44	11,97	63,52	1,95	16,28	57,99
4	1,01	8,45	71,97	1,68	13,98	71,97
5	0,86	7,15	79,12			
6	0,70	5,79	84,91			
7	0,62	5,16	90,07			
8	0,39	3,27	93,34			
9	0,33	2,72	96,06			
10	0,24	2,04	98,10			
11	0,16	1,36	99,46			
12	0,06	0,54	100,00			

In table 6b we can view that the first component is associated with professional networks, personal contacts, inside the company and most sources of information, the second factor is related with expositions and universities, the third factor relates to consulting and other firms, while the fourth factor

**Table 6b – Factor Analysis – Information Sources**

Components	1	2	3	4
Professional networks	0,79	-0,42	-0,16	
Personal contacts	0,76	-0,45	-0,31	
Inside the company	0,70	-0,48	0,29	0,11
Clients	0,69	-0,42	-0,23	-0,13
R&D Laboratories	0,64	0,21	0,19	0,38
Consulting firms	0,61	0,11	0,44	-0,43
Competitors	0,60	0,39		-0,45
Other companies	0,55	0,38	0,16	-0,23
Suppliers	0,55	0,23		0,42
Conferences and scientific journals	0,53	0,51	-0,38	0,34
Expositions	0,42	0,42	-0,64	-0,20
Universities	0,40	0,19	0,60	0,24

In table 7a we can see that this analysis on factors that difficult the in innovation process shows three components were identified, explaining 69% of the variance and with a KMO of 0.75.

**Table 7a – Factor Analysis – Innovation Difficulties**

Components	Initial Eigenvalues			Rotation Sums of Squared Loadings		
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	6,79	52,22	52,22	3,55	27,34	27,34
2	1,13	8,72	60,94	2,74	21,05	48,40
3	1,08	8,33	69,27	2,71	20,87	69,27
4	0,91	6,96	76,23			
5	0,82	6,33	82,56			
6	0,63	4,87	87,42			
7	0,49	3,77	91,19			
8	0,35	2,68	93,88			
9	0,28	2,18	96,06			
10	0,19	1,48	97,54			
11	0,15	1,16	98,70			
12	0,12	0,95	99,65			
13	0,05	0,35	100,00			

In table 7b we can view that the first component is associated with lack of clients acceptance, technology knowledge and market information the second factor is related with financial means, risk perception and innovations costs while the third factor relates to market dimension, lack of cooperation efforts and low workers mobility.

**Table 7b – Rotated Solution – Innovation Difficulties**

Components	1	2	3
Lack of clients acceptance	0,83	0,22	0,10
Lack of technology knowledge	0,82	0,16	
Lack of market information	0,75	0,33	0,40
Lack of trained personal	0,60	0,39	0,36
Inflexible organizational structure	0,58	0,12	0,50
Excess norms and regulations	0,54	0,51	0,26
Lack of financial means	0,32	0,83	0,16
High risk perception	0,30	0,81	0,29
High innovation costs	0,10	0,76	0,21
Reduced market dimension		0,16	0,81
Lack of cooperation efforts	0,13	0,27	0,74
Low workers mobility	0,42	0,23	0,68
Low costumers expectations	0,50	0,25	0,52

#### **4. DISCUSSION AND CONCLUSIONS**

From the analysis of the result presented above, we found disparities in level of adoption of new technologies, managerial and technical expertise, training and exposure to available technologies and other infrastructures between organizations. In the organisations studied, the imbalances could be broadly attributed to differences in sector or industry, management education and sales volume or dimension.

The elements of cooperation are also important and we could observe that companies in the first group we found, that had more innovative aspects implemented were cooperating more with consultants and clients, while other groups of companies were more connected with public administration.

When analysing the different sources of information used by companies we could observe that companies would associate professional networks, personal contacts and inside company information, while cooperation with universities and expositions seem to come together and consulting and cooperation with other firms would be another route to information.

Considering the difficulties to implement innovations we can see three main types of problems that firms identify: a first component, that is associated with lack of clients acceptance, company technology knowledge and market information; a second factor, that is related with financial means, risk perception and innovations costs while the third factor, relates to market dimension, lack of cooperation efforts and low workers mobility.

In global terms after dividing the firms in three groups, the analysis shows that dimension and industry are aspects that constrain innovation along with management education and values. More innovative companies seek cooperation with consultants and clients and seem to be a reason for more difficulties on innovation derived from market dimension, lack of cooperative environment and low mobility that can be associated with more disfavoured regions.

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