"Competitive" Advantage?: Identifying the Key Determinants of Industrial Clustering in the Cases of Limerick and Toulouse

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Research Question:

For many years scholars have attempted to identify the types of policies and structures that are necessary factors in successful economic development. The recent theoretical discourse has asserted the formation of industrial clusters as an alternative leads toward not only successful, but also rapid and sustained economic development. The cases of the Toulouse aeronautical technopole and the Limerick software industry network both exemplify rapid and sustained growth and exhibit characteristics of industrial clustering. Thus, these two particular regions were chosen as case studies to help us further pinpoint the importance of specific factors that lead to successful cluster formation and subsequent economic growth.

Many authors have explored this clustering of firms, and vigorous debate surrounds the importance of the various factors that lead to cluster formation. The influential cluster theory of Michael Porter stresses the importance of competition and large multi-national firms as determinants of cluster formation, whereas the authors Boyer and Hollingsworth emphasize the importance of small and medium-sized firms as well as market forces as causal factors for cluster formation. For the purposes of this study we have applied a set of determinants, based in part on those set forth in Porter's argument, to our case studies. However, the theoretical work of various authors remains relevant and plays an important role in our study

Literature Review:

Of the recent theoretical approaches focused on economic growth strategy, one of the more influential is the cluster-centered approach. The factors that lead towards the creation of these clusters, the success of these clusters and ultimately the economic benefits of clustering are open to continued debate. Clusters arise, in theory, because proximity and a sharing of resources increase the competitive advantage of all firms within the cluster. As a result, the development

and upgrading of clusters has become an important agenda item for governments, companies, and other institutions.

Michael Porter, a Harvard Business Professor, was the first to popularize the concept of clusters in his book *The Competitive Advantages of Nations*. He focuses on clustering because he believes it creates conditions that give companies a competitive advantage in the market.[1] Porter talks of a "diamond of advantage," which include factor conditions that exist due to demand conditions, industry strategy/rivalry, and related and supporting industries. Porter believes that all conditions are necessary, but argues that "factor creation is perhaps most strongly influenced by domestic rivalry" (Porter, 1990:134). Porter believes that the clustering of firms will lead towards vigorous competition that will result in the rapid development of skilled workers, the creation of related technological industries, and specialized infrastructure that gives each firm within the cluster a competitive advantage. He states that although a large firm can have some effect on factor creation, a group of rivals will be more innovative and productive (Porter, 1990:134).

The role of competition is a major factor for Porter. He believes that increased local and domestic competition will lead toward the creation of related and supporting industries and that these industries will be able to take advantage of the factors developed as a result of clustering. Demand can heighten this domestic competition if the domestic market becomes specialized and more discriminating in what the cluster produces. If local and domestic demand is high in a specific sector, it will encourage public and private investment towards factor creation. Demand also influences the breadth and specialization of the supporting industries because higher home demand will encourage the creation of firms to meet the specialized and unmet needs of the industry (Porter, 1990:138). If there is a lack of motivation to innovate and firms fail to meet

new buyer needs, create new technologies and new processes, they will lose the competitive advantage gained through clustering. The competitive advantage of clusters emerges from pressure, challenge, and adversity, because only through these driving forces will industry continue to innovate and as a result lead towards self-sustaining growth (Porter 1990:147)

An alternative theoretical approach comes from Mick Dunford in *State-Industry Relations, Inter-Firm relations and Regional Development* (1989). Dunford recognizes that traditional industries have been replaced by a new industrial relationship based around electronics and information technology. He does not use the term "clusters", but observes that "competitive edge lies with networks of small firms related via market transactions or with vertically integrated corporations whose interrelated activities are organized hierarchically" (Dunford 1989:24). He concludes that only through state involvement can independent, national, or indeed "European" industries be developed. He draws this conclusion because he believes that the threshold for entry into technological markets is so high that late entries into the market must have government assistance. Porter does note that the government plays a role in creating the initial factors necessary for clustering, but he downplays the role that government might have in generating and maintaining factor conditions for clustering.

Boyer and Hollingsworth make similar observations, but reach very different conclusions. They argue that "some of the most competitive firms, regions, and nations are based on mechanisms of economic coordination that are totally different from pure market mechanisms" (Boyer and Hollingsworth, 1997:433) They argue that market forces should be tamed, rather than merely tamed (Boyer and Hollingsworth, 1997: 477). Only short-term and marginal choices can be left to the market. Instead the market must be controlled by coordination between firms. "The most competitive firms, regions or nations are not mimicking the market,

but on the contrary, they are struggling to manufacture consensus, trust, collective forms of governance and long-term vision" (Boyer and Hollingsworth, 1997: 477). This creates an important contrast to Porter because it encourages cooperation among all actors in the economy. This negates Porter, because Boyer and Hollingsworth advocate cooperation as a way to tame and precede the market, while Porter sees rivalry and competition as a means for efficient market response. They also would disagree with Dunford, to some degree, because they question whether government should be creating inter-firm networks—it could be too great an attempt at controlling the economy.

Main Argument:

Many of the factors Porter identifies for clusters are present in the two comparative cases, but his emphasis on domestic competition as the driving force for innovation seems to not play as large a role as he believes. But if domestic competition is not the driving force for innovation, what is? We argue that government subsidies and policies can encourage a spirit of cooperation, and that this can replace domestic rivalry as the motivating force for growth and innovation.[2] In both of our cases the clustering is built up around industries that had very high thresholds of entry (software and aeronautics) because of an already globalized market. Porter puts such a large emphasis on domestic rivalry because he looks at clusters that can compete on the domestic level. There is little domestic competition in our European cases, as is evidenced by a high degree of specialization in Toulouse and the need to compete globally in Limerick. This study proposes that the innovation in these areas is linked to government subsidies that helped these areas enter established markets. Furthermore, continuing aid in the areas of research and development led to growth of the clusters.

Definition of Variables

The dependent variable of this study is the successful development of clusters. The indicators for the dependent variable are geographic concentration, inter-firm networks, innovation and vibrance of sector. Our basic definition of clusters is "geographical concentrations of industries that gain performance advantages through co-location."[3] These industry clusters are geographic concentrations of competing, complementary, or interdependent firms and industries that do business with each other and/or have common needs for talent, technology, and infrastructure.

Four independent variables are applied to explain the development of clusters: sector and market structure, socioeconomic culture, government policy (national and regional), and domestic competition. The sector and market structure variable examines the relevant growth rates and demand conditions for the economies of Toulouse and Limerick. The entrepreneurial spirit of the respective communities defines the second variable of socioeconomic culture. This variable has an effect on cluster development, but is not distinguishable according to a uniform set of criteria. Government policy is the third variable, defined as national and regional growth policies. Relevant factors and indicators are the provision of capital, either through direct subsidies or low taxes, and infrastructure through the strategic provision of universities, technological parks and research laboratories. Domestic competition is analyzed by the manner in which the cluster or potential cluster competes in its specific market. Being Porter's key variable, it is intended to measure the levels and quantity of competition and to what extent competition drives innovation, and thus cluster formation.

Logic of Comparison:

Limerick's and Toulouse's important differences and superfluity of similarities provide for an excellent comparison and controlled environment in which examination of cluster

development can be made. Limerick and Toulouse share much in terms of geography, histories of economic development, and the political contexts of that development. Geographically, both cities are relatively isolated from their respective (and in both cases very strong) capital cities. Both are second-tier urban centers of their countries that have been historically important centers for trade, and both have major international airports.[4] The bases of their economic development have also shared many factors. Both cases were "passed over" by the industrial revolution, leaving them primarily agricultural and abundant in land until after World War II. Also, both possess universities deliberately geared toward applied science and technology, that aim towards minimizing the transaction costs between businesses and researchers. Finally, both share a political context to their development in that they both possess regional development agencies (although with differing levels of competence) that have been given the task of managing economic decentralization.[5]

The differences most prevalent between Limerick and Toulouse are their levels of economic and cluster development and the structural nature of the clusters in Toulouse and Limerick. Toulouse is significantly more developed than Limerick. Its cluster is part of a European firm that dominates the global market of civil aircraft manufacturing. While Limerick has a variety of inter-firm networks, university linkages, and technological parks, it does not possess any powerful international software competitors.[6] There are also important differences in the structural nature of the cities' clusters. In Toulouse, the cluster is characterized by vertical relationships between a buyer and multiple sellers (Airbus and its supplying firms). In Limerick, the clustering that is occurring is characterized by horizontal relationships between software and technological firms that are competing for similar markets abroad, especially on the continent and in the U.S.[7]

Operationalization:

We chose to establish the existence of industrial clustering (dependent variable), in the cases of Limerick and Toulouse through evaluating the four indicators of inter-firm networks, geographic concentration, innovation, and the relative vibrance of different industrial sectors. Inter-firm networks and geographical can simply be evaluated in terms of their presence or absence, as well as the presence of technology and industrial parks. Innovation, while difficult to measure, has been operationalized by the relative research and development turnover rates and through determining the linkages between universities, businesses and research institutes. Finally, the distribution and change in labor force and GDP in the sector can be used to measure the presence and strength of industry in the regional economy.

We have chosen four independent variables that we believe best explain the main determinants of cluster formation. While we achieved numerical measurements for all indicators of the dependent variable, the independent variables are generally more categorical. National and regional government policy is operationalized as the degree to which government provides subsidies and tax incentives for industry, the provision of infrastructure for these industries, and the support of the government in generating the necessary research and education facilities. The variable of sector and market structure accounts for the important effect of the sector being developed. The demand conditions in these sectors are also international in character. Socioeconomic culture is not necessarily quantifiable, but is characterized in France by the general unwillingness to independently start up competing firms and in Ireland by poor investment in innovation. We then measure the number of competing firms and their level of specialization in an effort to capture domestic competition.

Case Study: Toulouse

Toulouse has a reputation throughout Europe as a hub of business activity and of high-tech research and production, but this was not always the case. In just three decades the economic growth in Toulouse has been extreme. As a result of research and interviews, we have seen that the rapid economic revitalization can be attributed to the successful clustering of Airbus and the aeronautics industry in the greater Toulouse area.[8] Airbus alone provides 11,500 jobs and the related businesses that have clustered around airbus provide an additional 43,000.[9] Airbus has a network of 500 supporting firms and as an industry they provide nearly a billion Euros worth in salaries to the economy each year. Yet, Airbus and Toulouse were not successful until they became capable of innovation. Airbus was only able to enter the commercial aerospace market if it created planes that were technologically superior to Boeing's. This is important to note, because although innovation is hard to quantify, the success of Toulouse can almost be completely attributed to the ability of industry to innovate.[10] Airbus has demonstrated this desire be reinvesting 36% of their yearly profits back into R&D.[11] While Toulouse has furthered this dedication to innovation by boasting the second largest university system in France[12] and also through the creation of over 400 centers of research.[13]

The sector and market structure has played a key role in the cluster development of Toulouse. It is likely that the successful and rapid formation of clustering in Toulouse was due to the unique nature of the aeronautics industry. This industry is one that does not have many major actors, and because of the complexity of commercial airliners, inherently requires a large number of supporting small and medium sized firms in close proximity. The formation of Airbus was also an attempt by Europe to challenge a market that was almost completely controlled by Boeing. Perhaps Toulouse is a unique case because it had to create a clustered system in order to

meet the high threshold of entry into the market. Clustering is often credited with innovation, and the innovation that occurred in Toulouse was essential for Airbus' success in rising to the top of the aeronautics industry in only three decades.[14] It is important to note that because of the bipolar nature of the commercial aeronautics industry, there is not the diffuse and fierce competition that exists in other industries.

National and regional government policy takes on significant weight in the Toulouse case as a causal factor in cluster formation. The national government's post-World War II push toward decentralization provided the setting for cluster formation to be possible outside of the Ile-de-France (Paris) region. However, its influence in the growth of Toulouse extends far beyond its placement of disincentives on industrial location in Paris. The government has also been involved in Toulouse through massive subsidies to Airbus. One hundred percent of Airbus' bank loans are covered by the national government, which also covers ninety percent of Airbus' new aircraft development costs.[15] Airbus does not have to begin repaying the national government until it actually sells its aircraft. The government has also played a major role in infrastructure and industry development in an effort to promote the Toulouse technopole.

The high levels of industrial specialization overpower domestic competition in the Toulouse case. According to Laurie Farris, from the U.S. Consulate in Toulouse, a very high degree of specialization within the production chain for Airbus has resulted in low levels of competition. As has already been explained, many enterprises in the technopole have pooled their resources toward research and development due to the fact that they are non-direct competitors within the same production chain and can gain nothing but competitive advantage as a result of cooperation. This lack of demand fails to match Porter's claims regarding the role of domestic rivalry.

Toulouse's socioeconomic culture is derived from the overarching culture of France. The longstanding precedent of a highly centrist government in France is reflected on the economic attitudes of the French people. Initiatives for political action are taken at the national level in Paris. Paris then implements its policy to the focused region. It is Paris who identifies the problem and solves it. As U.S. Consular Farris commented, "France is stuck in its ways." Their centrist model of economic development has still existed even amidst decentralization.

Another factor in socioeconomic culture is the French socialist culture. While the French economy is capitalistic in nature, the attitudes of the people are ambivalent and anti-capitalistic. The French society refuses to involve itself in the "savage capitalism" of an American style economy. The product of this attitude is a low level of venture capitalism in France and a low level of inter-firm competition. Consulate Ferris stated that the French people do not enter markets unless their position is guaranteed, thus rivalry and competition is avoided by high degrees of specialization. This also explains the low frequency of companies merging in Toulouse. Small, specialized, family owned firms do not want to relinquish their establishment despite the resulting economic efficiency. Although larger and more diverse firms would better serve the interest of Toulouse's major firm, Airbus, the French socioeconomic culture does not support the merging of firms. This socioeconomic culture reflects the French ways of dealing with their economy and thus is a factor for the development of clusters in Toulouse.

Case Study: Limerick

Upon conducting research and interviews with academics and officials in Limerick, we have acquired a useful pool of information that we will examine to draw out the relationships between the independent variables and the dependent variable, cluster development. The cluster itself in Limerick is much less developed than that of Toulouse, but clustering has occurred.

Limerick has shown important progress towards achieving the four indicators of cluster development, but Limerick's cluster is by no means fully developed.

The Shannon Development Agency has established two major geographic concentrations of businesses. The Shannon Free Trade Zone at the Shannon International Airport attracts various businesses because of its no tax policy. The Plassey National Technological Park and Innovation Centre at the University of Limerick attracts high-tech businesses for research and innovation purposes (Andreosso-O'Callaghan 75).[16] These clearly exhibit the successful implementation of geographic proximity between businesses.

Inter-firm networks are also well established in Limerick, being another essential factor in cluster development. Numerous organizations exist to network and share information between businesses. Two important examples are the Irish Business and Employers Confederation (IBEC) and ShannonSoft. IBEC is a national organization with a branch focusing on the Mid-West Region that provides a variety of human resources and informational services to member businesses. ShannonSoft is an organization created by businesses, the University of Limerick, Shannon Development, and the Limerick Institute of Technology "with the explicit purpose of creating networks to establish pure software development in Limerick" (John Gleeson, 2002).[17]

Innovation in the high-tech sector is also higher than in the rest of Ireland, indicating the material reality of Limerick's cluster development. The average Irish national turnover spent on R&D in Ireland is 1%, yet in the Shannon region it is 2%, with indigenous firms in Limerick spending an average of 1.87%. Additionally, both electronics and mechanical engineering firms are more research-driven than their foreign counterparts in Shannon (Bernadette Andreosso-O'Callaghan, 78-79).

The sectors of electronics, computer manufacturing, and software are the most vibrant in Limerick. IBEC collected a variety of statistics about relative changes in the Mid-West Region between 1990 and 1995. In terms of how the labor force shifted, Industry and Services, which include computer manufacturing and software, were the two sectors that grew the most, by 33.7% and 23.5% respectively. Within Industry, the category of "other production industries," in which software and technological development fall, grew by the highest number of laborers among other industrial categories, from 20.4 thousand to 29 thousand, and now composes the largest portion of the Mid West region's workforce. In terms of regional GDP, the two industrial sectors that have grown most significantly in the Mid-West region have been Electronics and Internationally Traded Services (into which computer manufacturing and software are classified), with increases of 19.4% and 26.9% respectively. As a final major indicator of the new economic vibrance of Limerick, the depopulation that plagued Western Ireland for over 150 years has been reversed. Between 1986 and 1991, Limerick's population decreased by 1.6%, but between 1992 and 1996, it increased by 1.9%. As software and computer manufacturing are now the driving force behind Limerick, this amazing fact can be attributed to Limerick's vibrant new cluster.

The software and computer manufacturing sectors are very important when considering the driving forces of innovation and development of Limerick. Computer manufacturing and software development have only become vibrant global industries within the last fifteen years. As already mentioned, the software and computer manufacturing sectors are export-oriented for Ireland, even for small- and medium-sized firms, because Ireland lacks a large domestic market (O'Connor, 2002). This differs from the model for clusters that Porter presented. The implications of this market structure for Porter's diamond argument will be elaborated shortly. It

is also important to note that these sectors largely explain the fact that Limerick's development is significantly less than that of Toulouse. Aeronautics has been a strong industry since World War II. Comparatively, Dell, Limerick's largest employer, only established itself in Limerick in 1990. ShannonSoft, founded in only 1997, has worked to expand the software presence in Limerick from three initial member companies to a current membership of over sixty companies (John Gleeson, 2002). Limerick has been unable to complete even an infrastructure of ring roads and high-speed Internet access because of the very recent nature of its growth (Maureen Gleeson, 2002).

Government involvement in Limerick has been both strong and beneficial for cluster development. While cohesion and structural funds have been instrumental for urban development and the improvement of infrastructure, the Irish government has footed most of the actual cost of projects in addition to controlling how the funds were used. EU structural funds can only explain 1.5% of Ireland's average annual growth rate of 11.5% since the fund began (O'Connor, 2002). A new set of ring roads and improvements in the Dublin-Limerick rail service are near completion (Maureen Gleeson, 2002). Limerick regional government is now working to address inadequacies in its telecommunications network--"it costs as much to call from Limerick to Dublin as from Dublin to Boston" (John Gleeson, 2002). Benefits have come to international and indigenous firms in the form of extremely low levels of taxation: an EU-dictated 'harmonized taxation' level of 12.5% will be in place by 2003 (O'Connor, 2002) versus the EU average of 27% (Haar, 2002). Additionally, regional government, specifically Shannon Development and the Limerick Corporation[18] have played an essential role in the development of Limerick's cluster through establishing the Shannon Free Trade Area, the University of Limerick, the

Innovation Centre, and the Plassey National Technological Park (Andreosso-O'Callaghan, 2000: 75).

Although Porter lists domestic competition as a critical factor for clustering, there is a significant lack of such competition in Limerick's software cluster. Both the noted economist Donal Dineen and John Gleeson pointed out that Limerick's high-tech firms rarely compete with one another in terms of what they produce--their products are too specific in nature. Furthermore, they seek to export into the larger markets of the US and European continent. As the Irish market develops and the cluster grows, this may eventually change, but for now domestic competition in Limerick is negligible.

Conclusion:

Porter argues that one of the most significant aspects of domestic competition stems from the creation of an upgraded and educated domestic market. This is obviously not the case for either Limerick or Toulouse. Airbus services a very specialized global market against only one competitor, where Limerick is competing to enter major software markets in the United States and on the European continent. In neither case does the cluster receive the vital innovative drive that domestic competition is supposed to provide according to Porter, but innovation occurs nonetheless. The innovation comes instead from government provision of resources through infrastructure, university research, technological parks, and capital. While domestic rivalry and competition certainly serve as powerful drivers of cluster development, government may substitute for their presence, as is proven in both Toulouse and Limerick.

This has important implications for geographic proximity within a cluster. In Porter's framework, the variable of domestic rivalry serves in large part to draw competitors into geographic proximity through the creation of the highly focused and educated domestic market.

If this is so, then in cases where competition occurs for international markets (making Porter's "demand conditions" international), businesses have less incentive to cluster geographically. The other major incentive for clustering is the attractive force it has on skilled labor in the cluster's sector. Yet, until the cluster actually exists, there is no such attractive force of a pool of skilled labor for businesses. By providing specific infrastructure for clusters, governments serve the vital role of actually creating the physical proximity and the skilled pool of labor necessary for cluster development that would ordinarily be filled by domestic competition.

Furthermore, the socioeconomic culture of a region can also exercise an effect on what approach to cluster development is most appropriate. In the case of Toulouse, it is important to understand that Airbus provided a convenient guaranteed market for small- and medium-sized supplying firms that complimented the French cultural reluctance to engage in competitive capitalism and assume competition-related start-up risk. In Limerick, governmental promotion of innovation through the establishment of the University of Limerick and the Plassey National Technological Park was especially important in constructing an innovative cluster because of Ireland's traditionally poor investment in innovation. As Porter effectively demonstrates, government involvement is not always necessary in cluster development, but cluster development is more complex than the diamond that Porter outlined. There are different paths to be taken toward cluster development, involving varying degrees of government involvement and market freedom, and the best paths may be determined by the socioeconomic culture of the society building the cluster.

There are a variety of further questions and issues raised by the comparison of Limerick and Toulouse that merit further research. Limerick and Toulouse have clusters of a different structural nature--vertical and horizontal. What conditions are most conducive to the

development of the different types of cluster? Ireland faces challenging shortages of funds in the near future--it can no longer sustain its increased rate of spending and its extremely low taxes simultaneously, and structural funds are due to end in 2006. How vital is government-provided capital to the sustainability and further development of Limerick's cluster? Along similar lines, now that Airbus has "beaten" Boeing by taking control of the civil aircraft market (with over 51% market share now), will this slow government funding or innovation? Finally, the question of what effect clusters have on surrounding regional economies and society is far from answered. In Toulouse more than Limerick, the vibrance of the urban technopole may retard surrounding regional growth. We are then led to ask, “Are clusters inherently beneficial?” How do the benefits compare to the detriments? Can government policy offset the effects of concentrated development? As a consequence of the recent examination of the phenomenon of clusters, a wide variety of issues related to its development remain to be resolved.

Notes

[1] Porter goes beyond the basic definition of clusters to include vertical and horizontal clusters. Vertical clusters, he says, are made up of industries that are linked through buyer-seller relationships. Horizontal clusters include industries that might share a common market for the end products; use common technology or labor force skills, or require similar natural resources.

[2] Porter cites examples such as the software development in Silicon Valley to demonstrate how domestic, localized competition drives innovation. But Porter may have reached a different conclusion because the cases he examines are very similar.

[3] Doeringer and Terkla 1995, p.225.

[4] Especially important for Limerick.

[5] This information was acquired from a myriad of sources, including books, interviews, literature, volumes, other books, promotional materials, a llama named Fred, coupled with some input from Mike Carey about Sri Lanka, that had no relevance to our research at the time.

[6] The one major computer manufacturer in Limerick, Dell, is not linked strongly to Limerick

[7] A similarity that strikes us is that both cases lack any articulated domestic.

[8] Just half a century ago, Toulouse might have been better known for its flour and textile industries than as the European capital of aeronautics. Toulouse was virtually forgotten during the industrial revolution in the 19th century, and as a result most of its modern economic activity was limited to the production of basic consumer goods. This all changed with the development of Toulouse as the capital of the Aeronautics industry. In 1970, Aerospatial (France), British Aerospace (UK), Casa (Spain) and DASA (Germany) created Airbus in an attempt to challenge Boeing in the field of commercial aviation. They chose to place the Airbus headquarters and assembly plant in Toulouse and this brought with it scores of international aerospace companies, research centers, and other businesses. Since then, Airbus has become the economic heart and lungs of Toulouse.

[9] Almost 10% of the total population of Toulouse.

[10] There is no debating that the aeronautics industry has a large and influential presence in Toulouse, but what has made the city successful is that they have also diversified beyond aeronautics to become a host for a growing number of small and medium sized companies. This has provided Toulouse with the advantages of the aeronautics industry cluster, but also greater economic stability, long-term stability and faster growth because of a diversified economy. Toulouse was so successful at creating the infrastructure and inter-firm networks that were necessary for supporting the aeronautics industry, that it was easy for other industries to develop and utilize these resources. As a result, similar high-tech industries developed in the aerospace, electronics, microprocessors, and biotech industries.

[11] See *Panorama De l'économie de Toulouse et de sa region*.

[12] Toulouse has 110,000 students at four major universities (dating back to the 13th century) as well as 23 professional training colleges.

[13] These research centers employee 10,500 people in Toulouse.

[14] As of 1995, Airbus had 51 percent of the Market.

[15] Obtained through interviews and from the Flug Review article *The Airbus Story*.

[16] Limerick is part of the "Shannon Region," a non-federal regional area consisting primarily of Limerick, Shannon, and Ennis. Limerick belongs to County Limerick, which is in turn part of the Mid-West Region of Ireland).

[17] The Plassey Technological Park and Innovation Centre also have the explicit purpose of developing business linkages in the high-tech sector.

[18] The official title of The Limerick City Council .