



## Review

# Cultural industries and spatial economic growth a model for the emergence of the creative cluster in the architecture of Toronto



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## ABSTRACT

While the establishment of innovative forms of production and commercialization expressed in cultural industries contributes to an increase in culture, there is a significant lack of tools to assess the contribution of these innovations. This work creates a theoretical model that offers empirical evidence to explain the possibilities of growth and consolidation of spatial agglomerations endogenously from the endogenous growth theory to explain the emergence and consolidation of the Architecture Cluster at the Toronto Central Metropolitan Area in Canada (CMA). The study relies on a quantitative co-relational/causal-historical analysis methodology based on information obtained from the Canada and Toronto CMA Industry Profiles to test the hypothesis that cultural industries improve the development of the regional and local economy. The premise is to model accurate evidence that explains the importance of culture in relation to the generation of value and economic development. The results demonstrate that the endogenous dynamics of the region establish a cycle of growth in which the incidence of specialization, human capital, economies of agglomeration and complementarity between firms and industries determine the competitiveness of the region and the city, and the emergence of a creative architectural cluster in Toronto. This can be verified through the strong values of the concentration index in multiple correlations.

## 1. Introduction

In the late 1970s, capitalism's turning point constituted the emergence of a new paradigm, which considered the relationship between culture, economics, the productive transformation through post-Fordist principles, specialized labor for differentiated markets of high consumption, and creativity as a productive factor.

The analytical, utilitarian and rational representation of cultural economy is expressed through the emergence of cultural industries, a model of hybrid economic sectors, which combine cultural relations and creative practices in certain spaces, in order to attend the changes in the patterns of consumption and demand, which are affected by technology and the pursuit of competitiveness through innovation.

Contributions to the study of cultural economy from Pratt (1997), Scott (2001), Hesmondhalgh (2002), Markusen, Wassall, DeNatale, and Cohen (2006), Throsby (2008b), Lorenzen and Frederiksen (2008), Kloosterman (2010), Currid and Williams (2009), Flew (2010), offer notions and hypotheses focused on regional development and the new economic geography in order to understand cultural industries, their sectors and complex organizations.

In the relationship among the sectors within cultural industries, producers and firms have the proclivity to concentrate according to the nature of cultural products -creative, moral, idiosyncratic, symbolic, ideological, and conceptual-with patterns and economic characteristics that depend on social interactions, economic exchange, appropriation and dissemination of knowledge. These sectors also promote challenges related to the reproduction of growth factors in geographical spaces with thriving industries. Notwithstanding the recurring debate in academic circles regarding cultural industries, their efforts have not produced practical tools to assess their contribution to the economy.

Considering the above, the specific objective of this research is to build a theoretical model with empirical evidence to explain the possibilities of endogenous growth and consolidation of spatial agglomerations, therefore, to test the hypothesis that cultural industries improve the development of the regional and local economies. For this purpose, we considered the architecture cluster in the CMA (Census Metropolitan Area) of Toronto Canada, for being a thriving cultural industry that has influenced the regional economic growth. We chose this industry due to its relation with creative services and specialized human capital who are devoted to design-based creative work.

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The model is based on the theories of endogenous economic growth of Romer (1989) and Sala-i-Martin (1990), from which the driving variables –human capital and expertise– are emphasized. It is assumed that these variables have an impact on the territorial space by forming central districts that are adjusted geographically in the delimitation of a creative cluster. In this case, the premises of Storper and Walker (1991), Krugman (1990) and Scott (2001) are relevant.

We use a conceptual classification of cultural industries that are statistically weighted to describe the main variables, which will be refined to obtain accurate estimation data. The model outlines a quantitative methodology of co-relational/causal-historical analysis with information obtained from Statistics Canada and Toronto CMA, Industry Profiles. In the period under study, the results demonstrate that the endogenous dynamics of the region establish a cycle of growth in which the incidence of the specialization, human capital, agglomeration economies and complementarities between firms and industries determine the growth of the region and the city and the emergence of a creative architecture cluster in Toronto.

## 2. Conceptual framework of cultural industries and their exploration in the increase of creative regions

For some time, there has been a strong interest in academic and policy discourse in examining the importance of cultural industry and related concepts (Gibson & Kong, 2005; Hesmondhalgh, 2002; Kong, 2014; O'Connor, 2000; Pratt, 2004; Throsby, 2008a,b) as an alternative to development in the new economy. In brief, cultural industries represent one of the most prolific sectors, and as such, they are identified as suppliers of cultural products. In this regard Scott (2001), assumes that extensive sectors of production in the economy have a symbolic cultural content, while culture itself is provided in the form of marketable goods and services, which are coherently organized in cultural industries.

Such perspective consolidates an aspect within the cultural economics concentrated in production and consumption. The notion of culture as economics imply that production and consumption can be located within an industrial framework and cultural goods and services are considered in the same terms as other assets created within the economic system (Throsby, 2001, p. 126).

Meanwhile, Hesmondhalgh (2002) states that cultural industries are involved in the production and circulation of products, i.e., texts that influence the understanding of the world. Markusen et al. (2006, p. 6) analyze the impact of these industries by defining them as aggregates of sectors that are a part of the manufacturing and service industries; Pratt (2008, p. 107), assumes that cultural industries have an economic and cultural presence as their importance is based on the close relationship they have with production. As such, cultural industries are one of the potential drivers of growth and urban regeneration - a practical example of the complex hybrid relationships between production and consumption, the symbolic and the material.

Throsby, suggests that cultural goods and services require some input of human creativity in their production, they are vehicles for symbolic messages to those who consume them, and they contain intellectual property that is attributable to the individual or group producing the good or the service (2008a, 219).

Therefore, the productive process of a cultural industry is conditioned by the expansion in the number of employees with high levels of specialization in analytical thinking, decision-making, social perception, social skills, knowledge, experience and creativity (Scott, 2010, p. 115).

The endogenous economic process -most economic and human resources allocated for production are local- (Santagata, 2002, p. 2), that distinguishes cultural industries exalts them as a novel component of national economies that are able to generate measurable contributions to total employment and income. In this regard, there are significant efforts to assess their significance as a means to stimulate growth.

The advocacy, as evidenced by the economic activity, emphasizes the emergence of new forms of productive organization and the need for compatible strategies with alternative growth paths.

Theories and scientific research related to cultural industries have arisen since 1990, bringing new theoretical perspectives to understand these industries in terms of their use or exchange value, cultural or profit value, and their incorporation into the creativity-based economy model. Such model emphasizes innovation research, learning and dissemination of knowledge in the context of multiple interactions, symbolic and tangible values as part of a local social structure. Currid considers the informal social life as the central force, the *raison d'être*, for culture. Thus, cultural economics is more efficient in the informal social areas (2009, 4).

So, how do cultural industries work? They require ideas, creativity, cognitive skills, tacit and intellectual knowledge, learning, a favorable environment for the reproduction of interactions, an intensive feedback among the participants where such processes take place.

### 2.1. Endogenous effect

The theoretical basis that links these trends to economic growth lies in the endogenous theory and its renovation. First, the model of Romer (1986), whose distinctive feature is a production function with capital externalities, suggests that the positive externalities impact all firms within the economy due to learning by doing and the overflow of knowledge (knowledge spillovers) introduced by Arrow in 1962. Even the four basic inputs are capital, labor, human capital and an index of technology level (Romer, 1989, p. 10), it is the accumulation of human capital that determines the level of growth. Second, in the model of Sala-i-Martin (1990, 6–9) regarding constant returns to scale, to have a constant growth, the production function must show constant returns on inputs that can be accumulated (externalities). What matters is the quality of the labor force, that is, the accumulated human capital. Furthermore, the Sala-i-Martin model also states there are rents that contribute to the expansion of the frontiers of knowledge, such as research and development (R&D).

Thus, the proposal presented in this paper is based on assumptions where the use and organization of human potential are the key because it reduces the uncertainty of transferring knowledge, an endless source capable of multiplying investment revenues, fostering innovation and equipping itself with internal-external factors.

This statement implies that the evaluation of the variables attributable to local and regional economic growth is changed. Regulation of the productive activity and the key factors raises the debate about the implications of creativity and culture into areas where they are increasingly perceived as agents of change in economic growth.

## 3. Creative economic geography. An approach to the spatial logic of cultural industries

The assumptions of the endogenous theory are applicable to the territorial context. It has been shown that the intensification of the relationship among creative industries shifts the attention to the fundamental role of clustering forms (Lazzeretti, Boix, & Capone, 2008; Mommaas, 2004; Santagata, 2002).

The understanding of the production system and the processes of agglomeration in cultural industries are derived from conceptual theories of local growth determinants where internal factors are used intensively. In this aspect, it has been determined that the new economic geography is the first space from which the trend of cultural industries establishes its geographical territorial composition as it focuses on the specialization of endogenous factors and forms of creative organization.

Accordingly, we first argue the geographical organization of cultural industries, as explained by Storper and Walker (1991) in their work “the spatial dynamic of industrial growth” The main hypothesis is that industries build regions as sites of economic activity wherein they

have special capacities to achieve normal profits and attract resources and labor. As a result, productivity increases by the division and integration of labor, then prices decrease, and spatial concentration increases. Increasing returns are the result of internal economies that are supported by the agglomeration, intensification, and social division of labor.

Second, we contend that industries with high creative content are governed by externalities that arise not only from specialized industries and particular occupations but also from among those externalities established in various industries and geographic entities or cities (Lorenzen & Frederiksen, 2008).

In this paper, we discuss this trend based on the recent arguments of Boschma and Iammarino (2007), who drafted an addition to the proposal of economies of location, sector specialization and regional economies diversification. They found that overconfidence in sources of local knowledge can be a detriment to interactive learning and innovation and that such problems can be resolved by establishing additional local networks. Being connected to such networks is considered a precondition for cluster firms to survive.

Both the new economic geography and the evolutionary aspects are paradigms that have emerged from the traditional endogenous theories, and both contribute to the explanation of the productive phenomenon and the spatial extension of cultural industries in particular regions.

#### 4. Clusters, productive distinction of cultural industries

Empirically, it is important to observe that the configuration of cultural industries in a specific location creates an agglomeration among the constituent firms and that productivity increases based on specific competitive advantages of various creative clusters. This trend is explained by the fact that the world trade of creative goods and services totaled a record \$624 billion in 2011, surpassing the previous record of \$559.5 billion in 2010. Furthermore, the global trade of creative products doubled from 2002 to 2011, and its annual average growth rate was 8.8%, while exports from developed countries increased 12.1% annually over the same period, reaching \$227 billion in 2011, which amounts to 50% of the total global trade (United Nations Conference on Trade and Development, 2013).

In the cultural industries a pattern of expansion is promoted via the development of small- and medium-sized firms that are well integrated within a territory or local community. Accordingly, clusters are the particular expression of the cultural economy, which is, in essence, a geographical spatial adaptation with production systems and human capital in constant creative dynamism that transforms inputs into different specialized goods and services on demand.

Specifically, the centralization of creative cultural production in this economy recreates places with symbolic value, idyllic, extravagant, able to captivate visual. They represent prototypes of commercialized territories, which are spaces from the contemporary central city that have been designed, reconstructed or reconfigured. Cultural-creative industries work in complex spatial levels, such as the creative districts (Zukin, 1995); cultural quarters (Montgomery, 2003); creative cluster (Evans, 2009); cultural cluster (Mommaas, 2004); creative/cultural/art district (Lazzeretti, 2003; Le Blanc, 2010; Santagata, 2004); they represent diverse levels, types, and local systems.

For Mommaas (2009), the historiography of the culture spatiality is studied through the artistic districts (1970–1980) that used cultural spaces for revitalization purposes. Subsequently, cultural quarters emerged in many cities for purposes of revitalization, as a combination of public-private, residential and commercial cultural features (2009). In 1980, clusters of cultural industries were created in order to stimulate culture, arts and creativity in the local economies. In 1990, cultural industries became turning into clusters of creative industries that aimed to comprehend more industries, innovation, multiple forms of creativity and technologies (2009, 50–51).

Some analytic approaches do not make a distinction when using the

concepts of cluster and cultural-creative district. This is a clear influence towards its integration and implementation in urban and regional development strategies. Cultural clusters can originate as an initiative of informal organizations of cultural producers that seek the transformation of derelict buildings in the city into commercial areas through the implementation of strategies that enhance the visual aesthetic of the city (Mommaas (2004, p. 508).

Another perspective to explain the emergence of cultural clusters is analyzing the effectiveness of the implementation of institutional policies that promote their creation. Particularly, for Fromhold-Eisebith and Eisebith (2005) the top-down strategies are policies directed by the public sector that provide conditions to foster the emergence of a cluster supported by public funds through a centralized organization, which promotes economies of agglomeration and material and visual incentives to attract investments. On the other hand, the bottom-up strategies are lead by a small group of individuals or enterprises that are interconnected; they work independently from public policies and are effective making good use of the previous conditions of infrastructure and their social relations.

For Stern and Seifert (2010), a cultural cluster emerges organically from the decisions of cultural producers. It is an intimate phenomenon within the city and its urban communities, which concentrate cultural resources, non-profit art organizations, commercial cultural firms, and local artists. A cultural cluster is a potential profitable industry; physically, it is a local habitat for artists or creators, who live, get together and work, with the help of different infrastructures (Fung & Erni, 2013).

Zarlenga, Ulldemolins, and Morató (2013) suggest a categorization for cultural clusters according to the predominant social relationships between agents, organizations and the creative process that are involved in the cultural production. The three categories are: 1) The cultural cluster that is recognized by the relationship between cultural institutions and top-down bureaucracy; 2) The cluster of cultural industries determined by the relationship between production and consumption; and; 3) The cultural cluster derived from community relationships which give certainty to the interaction in the social and creative space.

Therefore, it is possible to distinguish between different types of effects that would foster a cultural cluster. This will help us to identify the multiple variables that explain the possibilities of endogenous growth in spatial agglomeration. Next, we describe the key facts and concepts to analyze the emergence of a creative cluster in the city of Toronto.

##### 4.1. Toronto, cultural industries and the creative cluster of architecture

Toronto, the largest city in Canada, is the capital of the Province of Ontario. It is also the commercial, financial, industrial and cultural center of the nation. It is organized on three geographical levels - the greater Toronto area, the census metropolitan area (CMA), which is the region under study in this research, and the regional municipality of Metropolitan Toronto (City of Toronto, 2016).

The Toronto CMA, with a total population of 6,129,934 inhabitants of which 46% reside in the City (Economic Development and Culture Division, 2016); is the fourth largest metropolitan area in North America. In 2014, the regional gross domestic product (GDP) grew by 3.4%, surpassing Ontario's 2.3% growth rate and holding 8.2% of Canada's workforce (City of Toronto, 2015). The composition by employment in 2016, counts 3, 417,400 total occupations.

Regarding the dynamic and economic performance of cultural industries, we estimate their structure by considering the 48 codes of the National Occupational Classification (NOC) based on the categorization developed by the Classification Guide for the Canadian Framework for Culture Statistics (CGCFCS) de 2011a,b.

Therefore, the cultural sector consists of a set of domains or categories with specific purposes that are practically used to classify cultural industries, products, and occupations within recognizable groups

**Table 1**

Classification of cultural industries in Toronto.

Source: Author's compilation based on the Conceptual Framework for Culture Statistics, 2011a,b.

Live Performing Arts	Architecture
Sound recording	Design
Audiovisual and Interactive Media	Advertising
Publishing	Collection of information
Patrimony and Libraries	

that may be subject to measurements for statistical purposes. These include libraries, live performances, visual and applied arts, written and published works, audiovisual and interactive media, and sound recording. At the same time, they are formed by products and support services, whose main purpose is to provide a creative artistic service or an intermediary input for a final product, that are essential for the creation and production of the creative chain of products (CGCFCS, 2011a,b). Thus, the cultural industries of Toronto are classified as shown in Table 1.

The more dynamic activities are publishing, editing, architecture (and related services) and sound recording, which means a high consumption level of high-tech products and a demand for specialized services. In the Toronto CMA 2011 Industry Profiles, these activities report a 17.7% share of total employment in the industries of the CMA (2011). Accordingly, it is assumed that the region has a predominant cluster of most industries, including architecture.

According to the Toronto CMA, architecture is a cultural industry characterized by the design of buildings and landscape. For statistical purposes, we used the North American Industry Classification System (NAICS) code (5413) referred to Architectural, Engineering and Related Services. In the Conceptual Framework for Cultural Statistics, the creative services included in this group are design and construction drawings, plans, studies and other services related to projects for public, private residential and non-private residential buildings, structures and environmental services as well as to urban planning (2011b). The architecture was chosen as a cultural industry due to its relation with creative services and specialized human capital devoted to design-based creative work. The art of designing buildings and landscape combines practices that create physical, material, and use value; and practices that are intangible and related to symbolism, aesthetic value, and semiotic content.

We identify the limits of a cultural cluster considering the dynamic of production in the architecture industry, which clustering strategies are defined through the concentration of design activities and creative practices in interaction with the urban environment. The endogenous specialization is determined by the services provided by the industry, the design practices that depending on different styles aim to create aesthetic and cultural value.

Architectural services have a high symbolic value; they produce experiences in the consumer beyond their basic functionality. The creative content of the products require knowledge-intensive competencies to foster innovation. The cultural production of architecture reflects the social aspect of creativity and its location through different forms of innovation in the city as “a local ecology of knowledge; delicate, subjective and frail, where the creative processes are nurtured by the constant exchange among a variety of heterogeneous entities that promote the development of new ideas” (Grandadam, Cohendet, & Simon, 2013, 1711).

Then, the geographic level is important because of the effects of density-term related to agglomeration economies-that are the means to reproduce creativity and innovation in forms of geographic clustering (Stern & Seifert, 2010). In this sense, the architectural regional cluster consist of 46,870 workers (2011), which is approximately 28% of all cultural industry workers in the Toronto CMA (see Table 2) and 15% of the industry total workforce, estimated at 2, 960,040 (The Economic

Development Division of the City of Toronto, 2011).

Particularly, the architecture of Toronto has geographic advantages; it is a place that fosters innovation and allows the dissemination of knowledge and the development of new projects. It is a city that attracts and retains architects with talent and manages risks between employees and employers (Gertler & Geddie, 2008). In addition, architects exchange information and experiences in the entertainment districts that are located in the streets adjacent to the agglomeration of architectural firms.

The labor market holds a bastion of human capital among three age groups mainly - 25 to 34, 35 to 44 and 45–54 years with seventy-five percent of formal jobs and the rest are self-employed. Furthermore, according with the Toronto Industry Profiles 2011, the creative cluster is a production system that is mainly constituted of small- and medium-size firms, distribution that may results in an intense inter-company division of labor, the development of new skills and innovative capacity.

**5. Model of spatial-economic growth in cultural industries for the emergence of a creative cluster**

We build a model that incorporates the influence of the cultural industry on the architecture in the Toronto economic space. In this proposal, the location quotient (LQ) is used to verify how concentrated an industry is in a region, which allows the comparison of specialization to the national average (Lazzeretti, Boix, & Capone, 2009), and accordingly, it is possible to develop an empirical estimate for each industry and its participation in the economy through employment. Thus,

$$\gamma c = \alpha X_1^{\beta_1}, X_2^{\beta_2}, X_3^{\beta_3}, X_4^{\beta_4}, X_5^{\beta_5} \tag{1}$$

where  $\gamma c$  is the LQ of employment in cultural industries of creative content in the cluster;  $X_1$  to  $X_5$  are variables representing agglomeration economies, human capital, specialization, consumption and related variety;  $\alpha, \beta_1$  to  $\beta_5$  are the set of parameters to be estimated;  $\gamma c$  means there are mobility and employment of creative workers within the industry. The function (1) is aligned using logarithms to produce a linear equation. Thus,

$$\ln(y) = \ln(\alpha) + \beta_1 \ln(X_1) + \beta_2 \ln(X_2) + \beta_3 \ln(X_3) + \beta_4 \ln(X_4) + \beta_5 \ln(X_5) \tag{2}$$

From this logic, equation (2) can be generalized to more flexible forms following the translog function (Berndt & Christensen, 1973 in Lazzeretti et al., 2009), which relaxes the restrictions on elasticity by replacing factors that allow a second order of crossed effects. Thus,

$$\ln(\gamma c) = \sum_{j=1}^G \ln(F_{ij}/f_{ij}) + \ln(E_j)^{(\beta+\varphi^{-1})} + \ln(K_j)^{(\beta+\varphi^{-1})} + \sum_{g=1}^G P_{g,j} H_{g,j} + \ln(C_j)$$

According to theory, the explanatory variables are divided into five groups.

Group 1. Agglomeration economies of local production systems (represented by  $j$  in the model) consider geographic industrialization and include the structure and organization of the industry. The indicators are design following Storper y Walker (1991) and the marshallians concepts mentioned by Scott (2010). The average firm size in the local production system prefers the organization of industry in small- and medium-size enterprises. Thus,

$$Size\ of\ the\ firm_j = \frac{T_j}{F_j}$$

where  $T$  is the employment (jobs) and  $F$  is the number of firms. A second indicator suggested by Lazzeretti et al. (2009), monitors the effect of firm size on the industries of large creative content in the local production system. Thus,

**Table 2**  
Employment in the cultural industry of Architecture<sup>a</sup>  
Toronto (CMA) 1993–2011.

	1993	1996	1998	2001	2003	2004	
Total Employment	23,320	24,550	28,600	33,320	35,640	39,140	
Employees	18,130	17,590	20,710	23,960	27,810	28,170	
Self-employed	5190	6960	7890	9360	7830	10,970	
	2005	2006	2007	2008	2009	2010	2011
Total Employment	41,240	33,340	46,430	47,430	38,560	51,520	46,870
Employees	27,350	24,360	36,290	35,210	27,960	41,010	35,300
Self-employed	13,890	8980	10,140	12,210	10,600	10,510	11,570

Source: Toronto Industry Profiles, 2008 and 2011.

<sup>a</sup> We use the North America Industry Classification System (NAICS) code (5413) Architectural, Engineering and Related Services.

$$Size\ of\ the\ firm_{ij} = \frac{T_{ij}}{F_{ij}}$$

where  $j$  is the local production system and  $i$  is the creative industry. Meanwhile, the local qualified labor market is estimated by the number of skilled workers in cultural industries. Thus,

$$Q_{ij} = \frac{QT_{ij}}{T_{ij}}$$

where  $Q$  denotes qualified employment that leads to the variable of specialization represented by ( $E$ ). In this particular case, constructing the variable of the firm size ( $j$ ) by implementing  $\frac{T_{ij}}{F_{ij}}$  and then comparing it to the number of firms of cultural industries that are most representative in the cluster is proposed. Thus,

$$Agglomeration\ Economies = \frac{F_{ij}}{f_{ij}}$$

where  $F_{ij}$  is the number of firms producing creative content within the local production system in a given year, and  $f_{ij}$  represents the number of firms in the cultural industries within the local production system over the same period.

Group 2. The endogenous economic growth of the cluster is estimated from ( $E$ ). There is evidence of increasing returns and accumulated externalities ( $\beta + \varphi^{-1}$ ). This is the sector of intermediate goods (spillover), and it uses the design from the research sector ( $R\&D$ ). In the proposal of Romer (1989), there are increasing returns to scale in the production function, which means that growth is driven by knowledge. Similarly, ( $E$ ) and ( $R\&D$ ) denote the stability of regional economic growth supported by innovation. Thus,

$$E_{R\&D} = Pa_{ij} / T_{ij}^{(\beta + \varphi^{-1})}$$

where  $Pa_{ij}$  are the local patents, practices, permits, or other units that represent the number of innovations registered by the creative workers of an agglomeration and that emerged from the intensification of accumulated externalities ( $\beta + \varphi^{-1}$ ).

Group 3. The inclusion of  $K$  is based on the endogenous growth theories, especially those of Romer (1989) and Sala-i-Martin (1990).  $K$  is estimated using the number of people formally educated (college graduates and postgraduates) who are involved in the local production system. Thus,

$$Human\ Capital\ (K)_j = T_{ij} / \sum T_{SFEj}^{(\beta + \varphi^{-1})}$$

where  $T_{ij}$  represents the total of highly qualified employees in the cultural industry within the local production system and  $T_{SFEj}$  is the number of workers within the cultural industries who are formally educated. The research sector uses human capital ( $K$ ) to produce new knowledge. In the model, ( $\beta + \varphi^{-1}$ ) represents the intermediate factors based on the transmission of ideas that promote productivity and is estimated at the end of the equation through related variety.

Group 4. The foregoing suggests maintaining a constant. Knowledge is spread effectively among sectors when complementarities in terms of skills and related variety are shared.  $RV$  is estimated using the three-digit entropic level index proposed by Boschma and Iammarino (2007). The value of the entropic indicator increases the most diverse creative profile of a local production system. Thus,

$$Related\ Variety_j = \sum_{g=1}^G P_{g,j} H_{g,j}$$

where

$$P_{g,j} = \sum_{i \in Sg} P_{i,j}$$

This, then, represents the sum of the sectors of two and three digits of each industry compared to the total share of employment,

$$P_{i, LPS} = L_{i,j} / \sum_{i=1} L_{i,j}, \quad y \quad H_{gj} = \sum_{i \in Sg} \frac{P_{i,j}}{P_{g,j}} \log_2 \left( \frac{1}{P_{i,j} / P_{g,j}} \right)$$

The proposal does not deny the existence or the benefit of external economies in a geographical area, but it adds the possibility of sustaining the equilibrium of the local innovative system by inducing alternative external variables through knowledge. Accordingly, its measurement relates to the importance of obtaining empirical results regarding externalities or spillovers of the industry - the factors ( $E$ ) and ( $K$ ), respectively.

Group 5. Consumption ( $C$ ) is determined. Thus,

$$Consumption = PIB\ Region / Pat_j$$

Consumption is linked to the process of production and the exchange of creativity within a localized production system.  $Pat$  represents the participation rate of a creative cluster in the GDP of the local production system, and thus, it can be used as a proxy, as long as it is measured in units (number of patents, practices, records, permits).

### 5.1. A model of the creative cluster of architecture: application and empirical evidence

The contribution of this paper is an explanatory model of driving variables in the cultural industry for the case of architecture in the Toronto region. The variables considered are agglomeration economies, specialization, human capital, related variety and consumption in a local production system. The functional relation is as follows:

$$Concentration\ Index = f(Agglomeration\ economies, Specialization, Human\ Capital, Related\ Variety, Consumption)$$

It is assumed that the predetermined variables explain the agglomeration index behavior as expressed in the following model (see Table 3):

**Table 3**  
Units of Measurement to be used in the design of the model.  
Source: Author's compilation

Variables	Unit of measure
$\widehat{LQ}$ = Concentration Index of Employment within the cultural industry of large creative content	Logarithmic Value
$EA_1$ = Agglomeration economies within the Local Production System (LPS)	Logarithmic Value
$E_2$ = Specialization (local density of patents and other representative units)	Logarithmic Value
$K_3$ = Human Capital of the LPS	Logarithmic Value
$VR_4$ = Related Variety	Logarithmic Value
$CO_5$ = Consumption of LPS	Logarithmic Value

$$\widehat{LQ} = \hat{\beta}_0 + \hat{\beta}_1 EA_1 + \hat{\beta}_2 E_2 + \hat{\beta}_3 K_3 + \hat{\beta}_4 VR_4 + \hat{\beta}_5 CO_5$$

The influence of the explanatory variables is based on the endogenous growth and the new economic geography theories.  $\hat{Y}$  is a function of  $X_1, X_2, X_3, X_4$ , and other multivariate factors whose contributions and functionalities are explained in Table 4.

To estimate the econometric model, it is necessary to purge the database of Statistics Canada and the Toronto CMA Industry Profiles of 2008 and 2011, within the period 1993 to 2011 for the following years: 1993, 1996, 1998, 2001, 2003, 2004, 2005, 2006, 2007, 2008, 2009, 2010 and 2011. From 1993 to 2003, the data sequence is not constant because some years are not available. The information is shown in terms of relations measured by employment, units of construction permits, qualified employment, firms and GDP. The information used is presented in Table 5.

The results are presented in Table 6.

### 5.2. Model assessment

At this stage, the parameters obtained are evaluated within the framework of the violation of the assumptions of the classical model OLS (ordinary least squares).

It is observed that the error in a period is positively correlated with the error of the prior period (autocorrelation), which is corrected by implementing an autoregressive model. Furthermore, the problem of multicollinearity is fixed by eliminating the CO variable for the period 1993 to 2011 (see Table 7).

In the presence of autocorrelation, we use a first-order autoregressive scheme AR (1) and a second-order AR (2) scheme. The corrections and the results are shown in Table 8.

The evidence proves that each of the explanatory variables has a positive impact on the concentration of the industry index and that the variables of specialization and related variety have a higher impact. In this particular context, the results confirm the existence of a cluster of competitive advantages, with concentrated and localized creative activity that is dependent on specialization, economies of agglomeration and complementarities between firms and industries. The central

**Table 4**  
Expected signs of the predetermined variables of the model.  
Source: Own elaboration

Variable	Expected sign	Marginal contribution
$EA_1$ = Agglomeration economies within the LPS	+	The additional employment in the firms within the LPS has a positive contribution to the cluster economic dynamic
$E_2$ = Specialization (local density of patents and other representative units)	+	The increase of a unit in the construction permits has a positive influence on the specialization of the LPS
$K_3$ = Human Capital of the LPS.	+	A unit increase of formally educated workers within the LPS shows a positive relation between the LPS and human capital
$VR_4$ = Related Variety.	+	The total employment between the sectors of two and three digits of each industry has a positive effect on the creative profile of the LPS
$CO_5$ = Consumption of LPS	+	For every unit of construction permits there is a positive impact on the LPS profile

conjecture regarding the presence of an agglomerate cultural industry capable of influencing economic growth in the Toronto region is resolved by contrasting the results of the proposed model.

From this perspective, the endogenous dynamic creates a cycle of growth in which the impact of the explanatory variables determines the competitive capacity of the architecture creative cluster in Toronto. The results indicate the prevalence of practices subject to the intensification of human capital and the interference of distinct networks of expertise among employees, firms, and industries, while also suggesting the existence of productive domestic economies.

Thus, the impact of the increase in E per unit on the concentration index provides positive externalities that have an influence on the rest of the firms due to learning by doing and the spillover of knowledge in local networks among architects. This result coincides with the assumptions of the endogenous theory as the response to the creative dynamic of the architecture cultural industry and its use as a driving factor in the economy of the Toronto CMA is supported by the application of this variable - the same variable that had a greater influence on the concentration parameters.

To achieve this dynamic, innovation (construction permits) is encouraged as it maintains stability and sustained growth. The strength of innovation lies in the function of the R&D (research sector) and is the result of the division between the research sector and the number of highly skilled workers in the local production system. Further, the factor  $(\beta + \varphi^{-1})$  mentioned by Romer (1986) is added to the equation as an indispensable factor of change, which generates a productive chain where the effective use of human capital promotes the existence of knowledge flow, information, and communication. This industry as a motor of the economy is based on the creativity of architects, which becomes an imperceptible asset. This is not the case with respect to innovations, however, where their participation in the marginal productivity and the long-term increasing returns is an estimable index of their contribution to the economy of Toronto.

The architect creativeness is the result of social interaction networks. Architectural practices promote high mobility among firms moreover, the flow of knowledge and the learning curve is more intense within the firms and particularly among the architects involved in a specific project. Within the cluster, they interact in the chain of creation, production, and distribution, promote endogenous relationships between key actors of the system as suppliers and consumers while encouraging links with other companies and agents related to the industry.

Meanwhile, the model explains the participation structure of related variety (RV). When RV increases, the exchange or complementary skills between firms, cultural industries, and architecture also increases. To Frenken, Van Oort, and Verburg (2007), this demonstrates a certain degree of cognitive proximity that results in effective communication and interactive learning among different industries.

The positive trend of RV has consequences for the industry concentration, indicating local specialization in relation to effective interactions, learning and innovation. Because the imperfections of the

**Table 5**

Variables of the model period 1993–2011

Source: Author's compilation with data from Statistics Canada (2012) and Toronto Industry Profiles (2008–2011)

	LQ	EA	K	E	VR	CO
1993	1.3	0.38751926	0.27134725	18.0015736	1.921131443	100236035
1996	1.4	0.38612368	0.24475983	14.1272842	0.730667024	90170132.3
1998	1.4	0.37437722	0.31764005	11.2447257	1.246234863	67130801.7
2001	1.2	0.3031206	0.22937053	9.6202144	0.903020457	57752220.5
2003	1.3	0.41365688	0.2812199	9.39158403	1.194145912	52851782.4
2004	1.4	0.37535855	0.18611747	10.2149037	1.605743263	56578565.4
2005	1.4	0.34037376	0.22788114	11.2812758	2.047868826	57431399.5
2006	1.2	0.29526917	0.26337281	11.2369338	0.902480541	74739372.8
2007	1.5	0.38309927	0.31823016	15.1162007	2.08970197	73980128
2008	1.5	0.41352278	0.3202686	16.8371758	3.434960444	78938760.8
2009	1.3	0.2746642	0.23407511	15.5814941	0.559311837	90541595.9
2010	1.6	0.41072925	0.29212078	17.849345	2.767663133	80667394.5
2011	1.4	0.37490318	0.33214364	16.7278063	1.809319678	83599046.2

**Table 6**

First estimation of the model.

Dependent Variable: LOG(LQ)				
Method: Least Squares				
Date: 07/16/12 Time: 19:15				
Sample: 1 13				
Included observations: 13				
Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	6.160780	4.619641	1.333606	0.2241
LOG(EA)	0.316321	0.152066	2.080160	0.0761
LOG(E)	0.419720	0.260990	1.608187	0.1518
LOG(VR)	-0.005072	0.058714	-0.086385	0.9336
LOG(K)	0.135143	0.112460	1.201696	0.2686
LOG(CO)	-0.356696	0.288946	-1.234470	0.2569
R-squared	0.841410	Mean dependent var	0.286589	
Adjusted R-squared	0.728131	S.D. dependent var	0.103338	
S.E. of regression	0.053882	Akaike info criterion	-2.700013	
Sum squared resid	0.020323	Schwarz criterion	-2.439267	
Log likelihood	23.55009	F-statistic	7.427782	
Durbin-Watson stat	2.044521	Prob(F-statistic)	0.010122	

Source: E-Views.

model variables prevent internal blocking means, the model is able to extend complementarities to other firms and cultural industries in terms of related variety, that is, they are linked through cognitive skills. Comparing RV to LQ levels indicate that firms connect to non-local or complementary networks, thus attracting new labor, migration flows, and alternative innovations.

EA explains the organization of the industry and the labor market.

**Table 7**

Revision of the OLS assumptions for the model of the architecture creative cluster in Toronto.

INITIAL MODEL						
LOG(LQ) = 6.160780011 + 0.1351431731*LOG(K) - 0.005071979831*LOG(VR) + 0.4197203581*LOG(E) + 0.3163213345*LOG(EA) - 0.3566958481*LOG(CO)						
	Calculated Statistical			Test Statistical		Observations
Heteroscedasticity	$\chi^2=10.94874$			Para 10 gl $\chi^2=18.31$		No heteroscedasticity problems
Autocorrelation	$\chi^2=7.589303$			$\chi^2=5.99$		There are problems of autocorrelation <sup>a</sup>
Multicollinearity	T	R <sup>2</sup>	F	T	R <sup>2</sup>	There are problems of multicollinearity <sup>b</sup>
	0.1009	0.9901	42.93	For 7gl 1.895	The closest to 1	3.97
	1.1009					
	3.4689					
	1.6446					
	1.8741					
	0.1423					

<sup>a</sup> The problem of autocorrelation is fixed using an autoregressive model.

<sup>b</sup> The problem of multicollinearity is fixed delimiting the variable CO.

**Table 8**

Final estimate of the parameters within the model.

Source: E-Views

Dependent Variable: LOG(LQ)				
Method: Least Squares				
Date: 07/16/12 Time: 17:20				
Sample(adjusted): 3 13				
Included observations: 11 after adjusting endpoints				
Convergence achieved after 15 iterations				
Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.094532	0.093663	1.009278	0.3699
LOG(K)	0.068726	0.039168	1.754659	0.1542
LOG(VR)	0.079815	0.011212	7.118700	0.0021
LOG(E)	0.172874	0.022194	7.789159	0.0015
LOG(EA)	0.179344	0.070089	2.558791	0.0627
AR(1)	-0.842339	0.170160	-4.950268	0.0078
AR(2)	-0.685290	0.151640	-4.519199	0.0107
R-squared	0.990044	Mean dependent var	0.290993	
Adjusted R-squared	0.975110	S.D. dependent var	0.112587	
S.E. of regression	0.017763	Akaike info criterion	-4.962326	
Sum squared resid	0.001262	Schwarz criterion	-4.709120	
Log likelihood	34.29279	F-statistic	66.29368	
Durbin-Watson stat	3.047858	Prob(F-statistic)	0.000587	
Inverted AR Roots	-.42 + .71i	-.42 -.71i		

The results show that the internal structure of the cluster and the business related to creative activity has a positive productive marginality. The effect of firm size indicates that an agglomeration is

comprised of specialized complementary networks that are in both competition and collaboration with others. Most of the firms in 2011 have no more than 20 architects, though there are some firms that have between 20 and 99 employees. The creative nature of production encourages a higher disintegration as producers constantly seek new combinations of labor and specialization to remain in the market, which also explains the positive results of the estimation model. It is further inferred that the marginal contribution to production is a function of the local workforce and its varied skills, abilities and sensibilities. Consequently, as the presence of distinctive capabilities among firms and workers are promoted, the interconnection of capabilities encourages the convergence of producers in the locality and the existence of strong internal resources.

Accordingly, to Storper and Walker (1991) the evidence suggests the presence of a cluster characterized by: the concentration of small and medium-sized specialized enterprises; an intense inter-firm division of labor; a high labor mobility; the presence of self-employment (formal and informal); strong networks of cooperation (cooperative competition) through partnerships; the use of infrastructure and common services; the execution of temporal contracts; and a close relationship with the local community. The positive sign of agglomeration economies within the model strengthens the premise that a creative cluster influences the long-term growth expectations in a region through endogenous dynamics and geographical impact. Such is the case of Toronto.

In this respect, the general adjustment of the concentration index, according to the formulations of the model, is supported by the growth per unit of K, whose positive relation in LQ confirms its significance. Human capital is unique and able to influence economic growth and the cultural industry in the region, along with technological change and innovation. By investing in formal education and through learning by doing, K becomes more specialized. Thus, the creation of knowledge is directly related to increasing skills within architectural firms throughout the productive structure of Toronto.

Such statements imply that the economy of the architectural industry emerges from the endogenous context related to the proposals of Romer (1989) and Sala-i-Martin (1990), as the creative component imposes the need to articulate growth around internal factors. By analyzing the outcome of the model, we recognize three concepts closely related to the increase of K - learning, creativity and innovation. Thus, the cluster is the particular expression of a geographic-spatial adaptation with production systems and human capital in constant creative dynamism, which, in turn, transforms inputs into differentiated specialized goods and services that are in global demand. The system depends entirely on the intense use of the variables as put forward herein.

## 6. Conclusion

The inception of the new cultural economy and the consequent extension of its products and services are reflected in the operation of the production system of creative-content industries that reveal a preference for distinctive processes in the specific locations where they are developed.

The economic fundamentals of such trends reside in the characteristics of the industries of cultural products, which are identified by networked production structures and a strong proclivity for geographic agglomeration (Scott, 2004). The presence of integrated cultural sectors dedicated to meeting the demand for intangible goods poses a challenge to the growth processes of the traditional economy.

The strategic role of cultural resources and the dynamics of economic concentrations demonstrate the ability to activate new production chains and to revitalize cities and regions. However, the interest in theories concerning the expansion of these industries shows a lack of information regarding the analytical tools needed to assess the economic influence of these resource and only few studies provide tangible

results. For example, Throsby (2008b), Lazeretti et al. (2009), and Scott (2010) discuss related schemes from work performed in countries such as the United States, France, Italy, UK, Canada and Australia.

Considering these assumptions, we build a theoretical model to offer empirical evidence and explain the possibilities of endogenous growth and consolidation of the architectural spatial agglomeration in Toronto, where innovative activity was spread in its initial stages, forged by architect's creative services and their design-based work specialization.

In this proposal, the groups of key variables with patterns that are geographically defined as a *creative cluster* are substantiated endogenously. We design a model with accurate evidence to explain the importance of culture in relation to the generation of value and economic development to improve regional and local economies. The agglomeration economies, human capital, specialization and related variety determine the growth of the region according to the contribution that each factor makes to the concentration of the industry.

With respect to the period under review, each variable shows positive margins, which allow us to infer that productivity is sustained. Such a statement reinforces the hypothesis that the cluster of Toronto exhibits a creative causality that transforms human capital and exploits distinctive synergies to activate the economic cycle.

Finally, the results of this work provide new areas of analysis to assess the impact of agglomerations with potential industries. These agglomerations represent a significant exchange regarding income and employment; the use and organization of human capital is key factor in reducing the uncertainty of knowledge transfer, multiplying investment returns and fostering innovation in various regions, then it may be conceivable to create tools to consider their contribution to the economy and their influence in other spaces.

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