ADOPTING NEURAL NET METHODOLOGY FOR LITERATURE MAPPING AND THE GENERATION OF RESEARCH IDEAS: AN EXAMPLE AT THE INTERFACE OF ENTREPRENEURSHIP, ICT, AND ECONOMIC DEVELOPMENT

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ABSTRACT

The present chapter demonstrates how the use of neural network software such as CATPACITM can aid researchers to map a vast amount of literature in order to identify emerging and established research trends. Furthermore, the use of this methodology allows for the generation of research ideas. This is particularly relevant in view of the substantially increasing number of global scholarly contributions. The utilization of
The methodology is exemplified at the intersection of literature bodies in entrepreneurship, information and communication technologies (ICT), and economic development.

**Keywords:** Information and communication technologies (ICT); economic development; entrepreneurship; bibliography; CATPACITM; neural net analysis

**SPECIFYING THE AREA OF ENQUIRY**

The substantially growing number of scholarly contributions around the globe makes quick surveys of the literature increasingly difficult by using traditional methods. The field of international marketing is affected by this trend in two ways. First and foremost, marketing research in the sense of market research often requires the analysis of a large set of qualitative data, especially with the advent of the Internet (Malhotra & Peterson, 2001). Secondly, the vastness of codified knowledge within the field often leads to specializations. Newcomers to the field such as Ph.D. students or scholars from other disciplines along with marketing scholars wishing to broaden their specialty are faced with the challenge of identifying key trends within a short period of time. The present chapter demonstrates how software packages such as CATPACITM can be used as a tool for literature mapping and research idea generation. While artificial neural network (ANN) softwares in general and CATPACITM in particular have been used in qualitative data analysis such as focus groups, interviews, website evaluation, etc. (Green, Wind, Krieger, & Saatsoglou, 2000; Malhotra & Peterson, 2001), their application for literature mapping has been limited.

The value of software packages such as CATPACITM lies in their ability to emulate the functioning of the human brain (Moore, Burbach, & Heeler, 1995). As discussed in more detail in the next section, the software methodically scans large amounts of qualitative data and builds neural networks based on the text’s grammatical and syntactical structure. The software is able to “remember” and to “forget” by assigning artificial “neurons” to individual words (Green et al., 2000). CATPACITM visually represents connections between words by using a clustering and multidimensional scaling program (Malhotra & Peterson, 2001). Further advantages of using ANN software as opposed to manual processing encompass the reduction of coder bias and human error, time and cost reductions, and an increase
in the depth of the analysis (Moore et al., 1995). Consequently, marketing researchers can not only use CATPACII™ to evaluate interview and focus group data, but can apply it to identify current trends in the literature. Also, looking at a cluster and/or multidimensional scale diagram can be used as a starting point for brainstorming new ideas.

As the emphasis in this chapter is on demonstrating how CATPACII™ can be used to map a large body of literature and how research avenues can be creatively derived from such an analysis, the context itself is less relevant. Thus, the present study builds on an analysis carried out in the context of entrepreneurship. In order to give some insights into the underlying thinking processes, the entire process from the selection of the starting point to the interpretation of the results is described. As a departure point for an empirical examplification the extent of research activity at the interface of entrepreneurship, information and communication technologies, and economic development was set out to be investigated. The next section gives an overview of how the software works and the context in which it emerged. Subsequently, the criteria for data collection and preparation will be discussed followed by the analysis and discussion of the results.

**SUITABILITY OF CATPACII™ TO AID LITERATURE MAPPING**

The shift from numerical to textual data entailed by the communication revolution (Iacobucci & Woelfel, 1995) and the consequential access to large amounts of information through databases such as ABI/Inform, EBSCOhost, Science Direct, etc., provide researchers with the prospect of gaining a better comprehension of their subject of study. However, despite the constant refinement of the database search engines to enhance their criterion specification aptitude, the quantity of data obtained is still tremendous. As a consequence, in order to best benefit from the promise of a solid understanding, Iacobucci and Woelfel’s (1995) appeal on being at the forefront of technology can be deemed legitimate. Self-organizing neural networks represent a particularly prominent tool for uncovering significant trends and patterns in an extensive data-pool (Iacobucci & Woelfel, 1995; Woelfel, 1993b).

The software package CATPACII™ exemplifies such an instrument capable of conducting semantic network analysis in a unique way. It differs from other text analysis programs like NVivo (Richards, 2000) or ATLAS.ti (Muhr & Friese, 2004), in that the latter cannot operate without researcher
input and draw on different types of coding (e.g., tree nodes, relationships, etc.) and the modeler function of the software (Samkin & Schneider, 2008). CATPACIITM, on the other hand, is designed to imitate the functioning of human biology (Jörgensen, 2005), which implies that it is capable of independent observation and learning. It is “well suited for tasks a human being might do, but, for one reason or another, can’t or won’t do” (Woelfel, 1998b). In this particular context, while it is possible for a researcher to read 800 pages of text and to code it manually in order to identify trends and patterns, the time-consuming nature of the process may cause the researcher to reduce the amount of data. Yet, despite the considerable acceleration of the analysis process, a substantial loss in depth and quality will be suffered. CATPACIITM’s ability to read and understand text allows the user to analyze large datasets in a relatively short period of time without substantial quality impairment. The tool identifies the most frequently used words and finds patterns in how these words were applied in the text under scrutiny (Woelfel, 1998a). The program discards insignificant words such as articles, prepositions, etc., via a prespecified “exclude” file. In addition to the list of words, users can add words they wish to exclude from the analysis. Subsequently, CATPACIITM assigns an artificial neuron to each remaining word representing that particular word (Woelfel, 1993a). When reading through the text, the software moves a scanning window through the entire text. On each occasion when a specific word is identified in the scanning window, the neuron representing that word is activated. CATPACIITM’s learning happens by employing a simple Pavlovian conditioning rule (Woelfel, 1993a):

\[ w_{ij} = w_{ij} + a_i a_j h \]

where \( h \) – “learning constant,” and \( a_i \) and \( a_j \) – activation of the \( i \)th and \( j \)th nodes.

This suggests that, “When two or more neurons are simultaneously active, the connection among them is strengthened. This means, quite simply, that neurons that have behaved similarly in the past are likely to behave similarly in the future.” (Woelfel, 1998b, p. 9).

Data Collection and Preparation

Data collection was carried out in a multistage process, building on procedures described by Noyons and van Raan (1998). In order to identify
relevant scholarly journals a systematic search was carried out in electronic databases such as ABI/Inform and EBSCO. The keywords “international,” “global,” “entrepreneurship,” “entrepreneurial,” “technology,” “Internet,” and “economic development” were specified as screening criteria. This resulted in 5,837 abstracts from 46 scholarly journals between the period of 2000 and 2008, which were subsequently exported into the reference manager software EndNote.

This first stage provided an overview of the journal landscape. After screening through the journals, 23 journals affiliated with different domains were selected: management, international business, economics, policy, development, entrepreneurship, international entrepreneurship, and technology. Next, the abstracts were carefully read in order to filter out papers that were not relevant to the topics. For this purpose a coding scheme based on the formula employed by Marino, Nekrassova, and Russ (2006) was developed, to facilitate the selection process:

1. Select paper, if the title of the article contains a reference to (i) entrepreneurship such as IE, new venture formation, or born globals, (ii) ICT (e-commerce, Internet, e-business, etc.), or (iii) economic development (emerging markets, developing countries, economic development policy, etc.) including international aspects. We chose to also include papers that do not touch upon all three areas simultaneously. We deemed this important in order to construct a more complete picture about the status quo of knowledge in this aggregate body of literature. The results regarding the research ability of the interface will not be diluted due to the way the software assigns neurons to individual words and handles them in the subsequent process of text reading.

2. If the title does not include a clear reference to any of the main topic areas read the abstract of the article. If the abstract is connected to entrepreneurship, ICT, and/or economic development, select it.

3. If after reading the abstract, it is still not clear whether the paper can be affiliated with one of the topic areas, skim through the paper. If it can be deemed relevant, select it.

4. Delete editorials, book reviews, and papers exclusively focusing on methodological issues or on detecting trends.

Despite the specified coding scheme the classification of the papers is, to some extent, based on subjective judgment. In order to control the reliability of the selection process, a second rater was involved. Coding instructions and the abstracts from a selected journal (Entrepreneurship Theory and Practice) were presented to a research associate (see Table 1). The rater was
then asked to apply the instructions and select abstracts that were deemed relevant. Results were then compared and Cohen’s kappa coefficient of agreement was calculated \cite{Cohen1960}.

The Kappa coefficient of 0.92 indicates a very high level of agreement. Minor disagreements were discussed and subsequently resolved. Following satisfactory reliability criteria, the remaining 1,377 journal abstracts were analyzed. The proportion of relevant articles identified in each journal is presented in Table 2.

The abstracts were then fed into a Microsoft Word file, to further prepare data for analysis in CATPACITM. Although the software is able to recognize frequently occurring terms in a text and establishes patterns of similarity based on their use, the development of a consistent coding scheme is still important, for obtaining coherent results. For this reason Samkin and Schneider’s \cite{Samkin2008} approach was adopted for this chapter.

First, the text was checked for spelling mistakes. Foreign language abstracts and copyright statements were deleted. In the second instance a uniform way of spelling was established. Grammatical derivatives and synonyms were recoded, to allow for the surfacing of key concepts. For example, the terms “enterprise/s” and “businesses” were replaced by the word “firm” and the expressions “strategy,” “strategies,” and “strategic” were substituted by the noun “strategy.” Additionally, the text was cross-checked carefully to identify homonyms. For instance the word “development” may stand in different contexts for different concepts, for example, it stands for growth and progress in conjunction with economic development, and for creation and improvement in conjunction with products and processes.

\begin{table}[h]
\centering
\caption{Level of Agreement.}
\begin{tabular}{lllll}
\hline
(ETP \(N = 120\)) & \multicolumn{4}{c}{Judge #2} \\
& Yes & (Chance) & No & (Chance) & Total \\
\hline
Judge no. 1 & Yes & 0.79 & 0.69 & 0.03 & 0.14 & 0.83 \\
& No & 0.04 & 0.15 & 0.13 & 0.03 & 0.18 \\
& & 0.83 & 0.17 & 1 & \\
\hline
\end{tabular}
\end{table}

\textit{Note:} see Cohen \cite{Cohen1960}.

\[ K = \frac{p_o - p_c}{1 - p_c} = 0.92. \]

\textit{Note:} \( p_o \) – observed agreement, \( p_c \) – calculated agreement by chance.

\section*{Table 1. Level of Agreement.}

\begin{table}
\centering
\begin{tabular}{lllll}
\hline
 \multicolumn{3}{c}{Judge #2} \\
 & Yes & (Chance) & No & (Chance) & Total \\
\hline
Judge no. 1 & Yes & 0.79 & 0.69 & 0.03 & 0.14 & 0.83 \\
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& & 0.83 & 0.17 & 1 & \\
\hline
\end{tabular}
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ANALYSIS AND RESULTS

The number of unique words required for the analysis was set to 70. The default value of the software is 25; however, as the aim of the analysis is to gain a better understanding whether, and if yes how, the three topic areas

Table 2. Journal Distribution.

<table>
<thead>
<tr>
<th>Domain</th>
<th>Journal</th>
<th>Abbr.</th>
<th>No. of Articles</th>
<th>Percent (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Management</td>
<td><em>Academy of Management Journal</em></td>
<td>AMJ</td>
<td>56</td>
<td>4</td>
</tr>
<tr>
<td></td>
<td><em>Journal of Management</em></td>
<td>JM</td>
<td>25</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td><em>Journal of Management Studies</em></td>
<td>JMS</td>
<td>15</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td><em>Management Science</em></td>
<td>MS</td>
<td>31</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td><em>Strategic Management Journal</em></td>
<td>SMJ</td>
<td>22</td>
<td>2</td>
</tr>
<tr>
<td>Economics and Policy</td>
<td><em>Journal of Evolutionary Economics</em></td>
<td>JEE</td>
<td>30</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td><em>Small Business Economics</em></td>
<td>SBE</td>
<td>93</td>
<td>7</td>
</tr>
<tr>
<td></td>
<td><em>European Planning Studies</em></td>
<td>EPS</td>
<td>13</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td><em>Regional Studies</em></td>
<td>RS</td>
<td>115</td>
<td>8</td>
</tr>
<tr>
<td>IB</td>
<td><em>Journal of International Business Studies</em></td>
<td>JIBS</td>
<td>56</td>
<td>4</td>
</tr>
<tr>
<td></td>
<td><em>International Small Business Journal</em></td>
<td>ISBJ</td>
<td>48</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td><em>Journal of World Business</em></td>
<td>JWB</td>
<td>49</td>
<td>4</td>
</tr>
<tr>
<td></td>
<td><em>Management International Review</em></td>
<td>MIR</td>
<td>28</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td><em>Journal of International Development</em></td>
<td>JID</td>
<td>36</td>
<td>3</td>
</tr>
<tr>
<td>IE</td>
<td><em>Journal of International Entrepreneurship</em></td>
<td>JIE</td>
<td>74</td>
<td>5</td>
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<tr>
<td></td>
<td><em>International Journal of Entrepreneurial Behavior &amp; Research</em></td>
<td>IJE</td>
<td>43</td>
<td>3</td>
</tr>
<tr>
<td>Entrepreneurship</td>
<td><em>New England Journal of Entrepreneurship</em></td>
<td>NEJE</td>
<td>40</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td><em>Journal of Small Business and Enterprise Development</em></td>
<td>JSBED</td>
<td>86</td>
<td>6</td>
</tr>
<tr>
<td></td>
<td><em>Entrepreneurship: Theory and Practice</em></td>
<td>ETP</td>
<td>99</td>
<td>7</td>
</tr>
<tr>
<td></td>
<td><em>Journal of Business Venturing</em></td>
<td>JBV</td>
<td>74</td>
<td>5</td>
</tr>
<tr>
<td></td>
<td><em>Technovation</em></td>
<td>Techn</td>
<td>180</td>
<td>13</td>
</tr>
<tr>
<td></td>
<td><em>Journal of Developmental Entrepreneurship</em></td>
<td>JDE</td>
<td>120</td>
<td>9</td>
</tr>
<tr>
<td></td>
<td><em>Entrepreneurship and Regional Development</em></td>
<td>ERD</td>
<td>43</td>
<td>3</td>
</tr>
<tr>
<td>Total</td>
<td></td>
<td></td>
<td>1376</td>
<td>100</td>
</tr>
</tbody>
</table>
relate, it was deemed appropriate to choose a larger number of unique concepts. The maximum number of unique words CATPACII™ can handle is 160. In that case, however, the results would have been less transparent. The window size was set at 5 meaning that the software reads five words at a time. Although the default value is 7, a size of 5 words is “sufficiently wide to accommodate the subject-verb-object syntax of English and not so wide as to allow words that are semantically unrelated to appear to be related” (Salisbury, 2001, p. 71). The default level of 1 was used for the slide size. This value indicates how many words the window will skip before reading the text, that is, CATPACII™ will read words 1 through 5, 2 through 6, 3 through 7, etc. The number of cycles referring to the analysis process was also left at the default setting of 1 as it is judged the most appropriate setting for most analyses by the software authors (Samkin & Schneider, 2008; Woelfel, 1998b).

After converting the Microsoft Word file into an ASCII text file, a hierarchical cluster analysis was carried out followed by the generation of a perceptual map based on multidimensional scaling (MDS). Both outputs use the same data; however, they allow for observation from different perspectives. It is important to look at both outputs as concepts next to each other in the hierarchical cluster may be visually far apart on the perceptual map (Samkin & Schneider, 2008). These output variations are due to differences in the two procedures. While, in a hierarchical cluster analysis, words are bundled together based on their co-occurrences “in an ordinal or discrete way,” MDS algorithms show underlying dimensions by predominantly focusing on key terms (Doerfel & Marsh, 2003, p. 221).

The text data contained a total number of 28,776 words in 11,025 lines. A list of abbreviations is provided in in the appendix. While Fig. 1 displays the results of the hierarchical cluster analysis using Ward’s method, Fig. 2 depicts how the concepts relate to each other.

The concepts “economic development,” “capability,” and “entrepreneurship” seemingly do not belong to any of the four clusters of the perceptual map. However, the hierarchical cluster output suggests that these terms represent the cornerstones of the results. Each cluster can be affiliated with at least one of these core concepts. The findings are deemed robust as there is no discrepancy between the hierarchical and the MDS clusters regarding the concepts involved.

**CLUSTER 1**

The first cluster emerged around the concepts “strategy,” “international experience,” “opportunity,” “motivation,” “orientation,” “environmental
Fig. 1. CATPACII™ General Output.
Fig. 1. (Continued)
Fig. 2. Perceptual Map.
knowledge,” “behavior,” “risk,” “relationship,” “culture,” “finance,” “performance,” “SME growth,” “resources,” and “ICT.” As they all can be associated with firm-level international/entrepreneurship drivers, Cluster 1 is labeled “MICRO-DRIVERS.”

The closest concept on the map to “ICT” is “internationalization.” “Opportunity,” “management,” “motivation,” “behavior,” “knowledge,” and “environment” are also within reasonable proximity to indicate a conceptual connection. The “opportunity” concept is positioned at an equal distance between “performance” and “management.” The unique words “relationships,” “orientation,” “importance,” “SME growth,” “international experience,” and “culture” can also be found in its immediate vicinity. While “orientation” is close to “relationships,” “management,” “opportunity,” and “international,” the concept “performance” is surrounded by “strategy,” “resources,” “finance,” and “creation.” “Culture” is to be found at an equal distance to “relationships,” “finance,” and “performance.”

**CLUSTER 2**

Cluster 2 contains concepts that are associated with factors driving entrepreneurship at a national level such as “technology,” “policy,” “innovation,” “job market,” and “networks.” Thus, it is labeled “MACRO-DRIVERS.”

Within this cluster, two subclusters emerged. The first one is concerned with differences between developing (DC) and developed (DDC) countries in terms of entrepreneurial activities. The concepts that emerged closest to “DC” on the perceptual map are “technology” and “industry.” The second subcluster unites the concepts “economic,” “role,” and “entrepreneurs.” The unique word “job” emerged directly next to “entrepreneurs” and at a minor distance from “market.”

While “policy” is positioned at an equal distance between “DC” and “DDC,” there appears to be a conceptual connection between “innovation,” “success,” and “policy” in conjunction with developed countries. “DDC” is further linked to the concepts “role” and “networks.” “Impact” and “differences” also seem to form a unit in direct proximity to “development,” “process,” and “markets” not far away from the unique words “job” and “entrepreneurs.”
CLUSTER 3

Cluster 3 is positioned between “economic development” and “capabilities” and contains the concepts “social,” “level,” “local,” “support,” “context,” and “region.” In the hierarchical cluster output, the word “capability” has to be read together with the word “context,” thus Cluster 3 can be termed “POLICY CONTEXT” indicating the different levels where governments can support entrepreneurial capability development.

CLUSTER 4

“National information,” “institutional influence,” “key sector characteristics,” “managerial learning systems,” “economy service,” “organizational competitiveness,” and “family investment” are the central joint concepts emerging in Cluster 4. As these concepts describe areas where government policy can help owner-managers to develop certain competencies, this cluster is termed “POLICY TARGET.” The unique concepts “government,” “service,” “change,” and “economy” form a subcluster in direct proximity to the “key sector change” subcluster. The concept “global” is closely positioned to “managers” and “systems.” “Economy” is surrounded by “change,” “key sector,” “service,” “characteristics,” and “government.” “Competitive” and “institutions” are also relatively close to each other on the map. The word “product” is positioned at equal distance between “information,” “national,” “manager,” “learning,” and “systems.” It is also close to “family,” “involvement” and “value” concepts that seem to form a close conceptual unit.

DISCUSSION

The perceptual map indicates that factors driving entrepreneurship and government policy issues are the two major themes, which emerged at the interface of the three literature streams under scrutiny. On the driver side of the output, the proximity of “ICT” to “internationalization” within the cluster and its relative proximity to “economic development” outside the cluster indicates a nascent scholarly interest in ICT’s role in the internationalization process (e.g., Arenius, Sasi, & Gabrielsson, 2005; Berry & Brock, 2004; Loane, 2005) as well as in its ability to foster economic
development (e.g., Izyumov & Razumnova, 2000; Oxley & Yeung, 2001; Shih, Kraemer, & Dedrick, 2007).

The subcluster containing the concepts “motivation,” “environmental knowledge,” “behavior,” and “risk” can be regarded as another topical unit. The proximity of motivation to behavior indicates a close relationship (e.g., Taormina & Lao, 2007; Ven, Tigineh, & Lanny, 2007). The link between motivation and risk also deserves attention (e.g., Dimitratos & Plakoyiannaki, 2003; Littunen, 2000; Schindehutte, Morris, & Allen, 2006; Tajeddini & Mueller, 2008). At this point, it needs to be noted that the term “risk” on the concept map subsumes both “uncertainty” and “risk.”

Another topic area that emerged from the MDS output is “opportunity.” While entrepreneurial opportunity constitutes an interesting research topic in itself (e.g., Lee & Venkataraman, 2006; Plummer, Michael, & Godesiaibois, 2007), ICT’s role in opportunity exploitation, the opportunity–performance, opportunity–firm growth, opportunity–motivation, and opportunity–international experience relationships seem to represent areas with ample research prospects.

Despite its primary affiliation with Cluster 2, the concept “entrepreneur” is positioned relatively close to “orientation,” implying a considerable role of entrepreneurial orientation within this body of literature (e.g., Clercq, Sapienza, & Crijns, 2005; Frishammar & Andersson, 2008; Tang, Tang, Zhang, & Li, 2007; Wiklund & Shepherd, 2005). The relationship between entrepreneurial orientation and firm performance/growth (e.g., Covin, Green, & Slevin, 2006; Frishammar & Andersson, 2008; Lee, Lee, & Pennings, 2001) is well documented in the literature. However, the concept’s proximity to “strategy” (e.g., Frese, Brantjes, & Hoorn, 2002), “motivation” (e.g., Ramsey & Ibbotson, 2005), “culture” (e.g., Lee & Peterson, 2000), “international experience” (e.g., Zucchella, Palamara, & Denicolai, 2007), and “ICT” (e.g., Fillis, Johansson, & Wagner, 2003; Ramsey & Ibbotson, 2005) also indicates interest in combination of these topic areas.

Seen together, technology and industry point to an important role of the technology industry for developing country entrepreneurship (e.g., Bruton & Rubanik, 2002; Thukral et al., 2008). In conjunction with developed country entrepreneurship the concepts “innovation” (e.g., Beugelsdijk, 2007; Bramwell, Nelles, & Wolfe, 2008) and “networks” (e.g., Andersen & Ploger, 2007; Andersson & Wictor, 2003) emerged. Yet, this result merely indicates that research attention within this particular body of literature is focused on networks and innovation in developed countries rather than in developing countries. It by no means implies that these two concepts are without relevance for developing country research. Policy, being positioned at an
equal distance between developed and developing countries, can be interpreted as playing an imperative role in the development of entrepreneurship (e.g., Audretsch & Fritsch, 2002; Blackburn & Ram, 2006). The self-employing function of entrepreneurs (e.g., Pietrobelli, Rabellotti, & Aquilina, 2004; Smith, 2005; Stel & Carree, 2004) is a further topic area detected on the perceptual map. Its proximity to “economy,” “market,” “process,” “strategy,” “resource,” and “finance” points to research interest in these directions.

The role of governments in fostering entrepreneurship by providing SME support in terms of information and economic services at local and regional level can be regarded as the central theme on the map’s policy side. “Competitive” and “institutions” are situated at a relatively close distance to each other offering the interpretation that institutions play an important role in firms’ ability to develop competitive advantages (e.g., Busenitz, Gomez, & Spencer, 2000). Furthermore, the role and “influence” of “institutions” in shaping “key sectors” and enhancing “economic development” is another topic area emerging from the concept map.

The subcluster “global,” “learning,” “system,” “manager,” “product,” “organizational,” and “competition” in conjunction with the conceptual closeness of “government” and “institutions” on the MDS output also point toward the importance and implications of policy measures in fostering international entrepreneurship through enabling and supporting firms to develop capabilities allowing for international expansion (e.g., Carayannis, Popescu, Sipp, & McDonald, 2006; Clercq et al., 2005).

**CONCLUSION AND IMPLICATIONS**

This chapter is set out to demonstrate the value of using CATPACII™ in analyzing large bodies of literature. To exemplify how this can be done, the intersection of entrepreneurship, ICT, and economic development has been investigated in terms of research activity. The resulting perceptual map clearly indicates the existence of research with ICT representing an important factor in the internationalization process and is positioned at a reasonable proximity to both concepts “economic development” (ED) and to “entrepreneurs” (ENT) and “entrepreneurship” (ENT).

The themes discussed above allow the deduction of three critical issues from the perceptual map. Firstly, in Cluster 2 (macro-level) it appears that research activity is more concentrated around developed countries rather than developing countries. However, as the selected journals are of U.S. and
European origin, this indicates a bias toward journals from developed countries. Future research may also consider to replicate the study using an even broader selection of journals including journals from developing countries. The second issue that appears is the focus on the cognitive dimensions of entrepreneurship in the literature (see Cluster 1). Whereas these dimensions are extremely important for gaining a better understanding of the entrepreneurship phenomenon, they are not suited to allow inferences about the impacts of entrepreneurship. Thus, future research may wish to concentrate more on the manifestations of entrepreneurship. Thirdly, in the center of Cluster 1 the concept SME emerges. It indicates that researchers primarily operationalize the entrepreneurial firm as a small and medium-sized enterprise. However, there are voices in the literature strongly objecting the equation of SMEs with entrepreneurial firms (Carland, Hoy, Boulton, & Carland, 1984). Corporate entrepreneurship research is a case in point. Future research is invited to investigate how empirical studies measure entrepreneurship.

Future research may also wish to simultaneously employ co-citation and neural network techniques within the same study to benefit from their complementarities. Using only one of these bibliometric tools invariably entails certain limitations. While in co-citation analyses time-lags are not considered and thus the most recent developments are excluded, neural network analyses are not fit to detect research communities. It also needs to be noted that the quality of the abstracts is crucial for the quality of the results. In our case this did not constitute a major problem given the nature of our research question. However, if future research aims to focus on authors' research recommendations or on specific findings of the studies, researchers are well advised to use the conclusion sections of the papers instead of the abstracts.

REFERENCES


### APPENDIX A: LIST OF ABBREVIATIONS FOR PERCEPTUAL MAP OUTPUT

<table>
<thead>
<tr>
<th>Context</th>
<th>CON</th>
<th>Local</th>
<th>LOC</th>
</tr>
</thead>
<tbody>
<tr>
<td>Creation</td>
<td>CR</td>
<td>Management</td>
<td>MA</td>
</tr>
<tr>
<td>Culture</td>
<td>CL</td>
<td>Manager</td>
<td>MR</td>
</tr>
<tr>
<td>Developed country</td>
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