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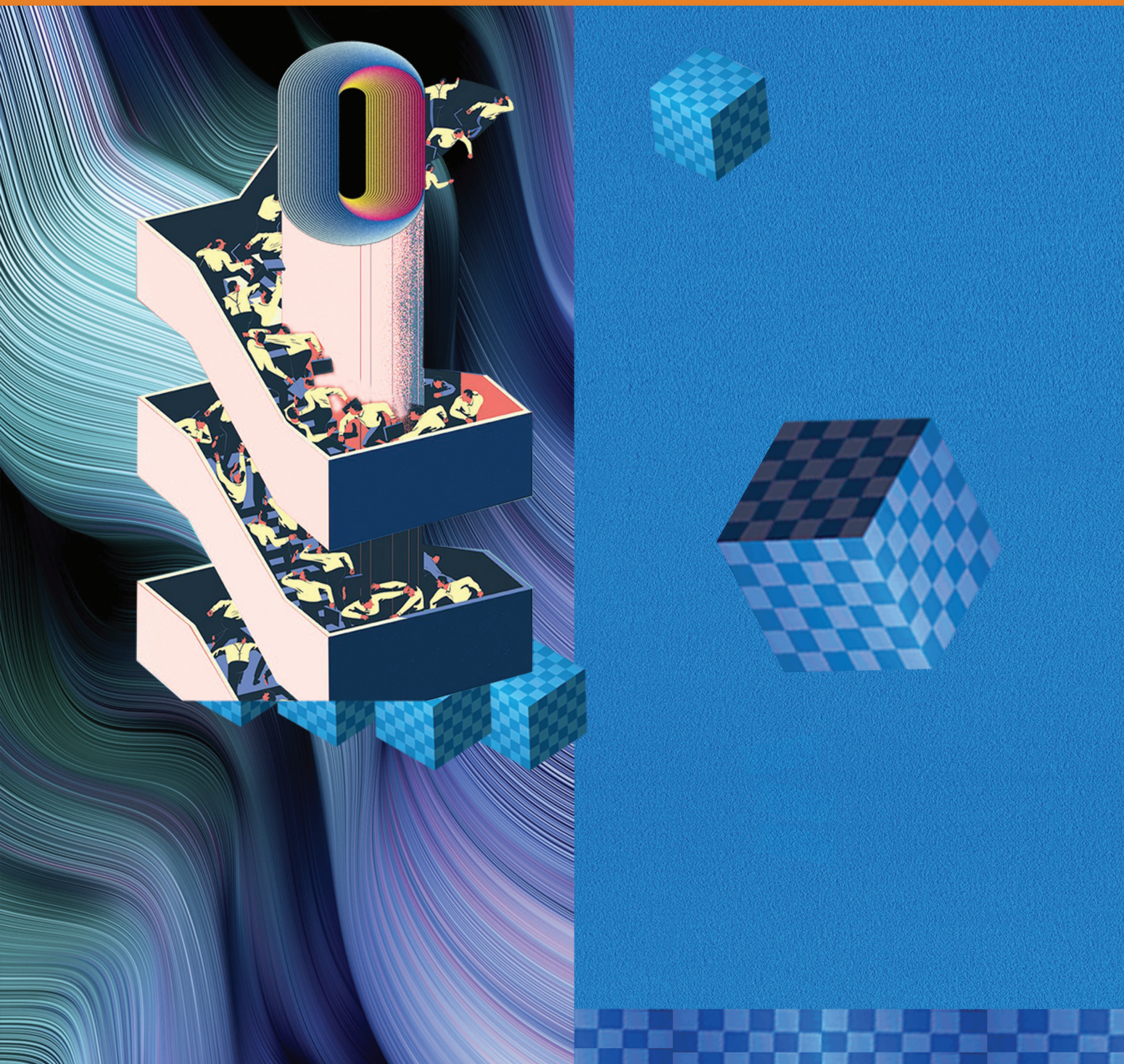
COMPETITIVE INTELLIGENCE



ABOUT THE JOURNAL

Foresight and STI Governance is an international interdisciplinary peer-reviewed open-access journal. It publishes original research articles, offering new theoretical insights and practice-oriented knowledge in important areas of strategic planning and the creation of science, technology, and innovation (STI) policy, and it examines possible and alternative futures in all human endeavors in order to make such insights available to the right person at the right time to ensure the right decision.

The journal acts as a scientific forum, contributing to the interaction between researchers, policy makers, and other actors involved in innovation processes. It encompasses all facets of STI policy and the creation of technological, managerial, product, and social innovations. *Foresight and STI Governance* welcomes works from scholars based in all parts of the world.

Topics covered include:

- Foresight methodologies and best practices;
- Long-term socioeconomic priorities for strategic planning and policy making;
- Innovative strategies at the national, regional, sectoral, and corporate levels;
- The development of National Innovation Systems;
- The exploration of the innovation lifecycle from idea to market;
- Technological trends, breakthroughs, and grand challenges;
- Technological change and its implications for economy, policy-making, and society;
- Corporate innovation management;
- Human capital in STI;

and many others.

The target audience of the journal comprises research scholars, university professors, post-graduates, policy-makers, business people, the expert community, undergraduates, and others who are interested in S&T and innovation analyses, foresight studies, and policy issues.

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The journal is included into the 1st quartile (Q1) of the Scopus Cite Score Rank in the fields:

- **Economics, Econometrics and Finance** (miscellaneous)
- **Decision Sciences** (miscellaneous)

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Photo images — JPEG or TIFF format. Minimum resolution 300 dpi, image size not less than 1000x1000 pix

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CONTENTS

SPECIAL ISSUE
"COMPETITIVE INTELLIGENCE"

Competitive Intelligence through the Eyes of the Professionals

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This special issue of "Foresight and STI Governance" is devoted to different dimensions of Competitive Intelligence — one of the key fields of futures studies — and its relation to foresight methodology. Earlier we noted that CR and Foresight are complementary activities [*Calof et al*., 2015; *Calof*, 2017]. Further, in the interviews for this article held with CI association executives, both mentioned foresight as being a key part of their fields. **Cam Mackey**, the executive director of Strategic and Competitive Intelligence Professionals described intelligence as a domain that "bridges hindsight and foresight with insight. Cam credits Professor Craig Fleisher, a former SCIP President[1] and prominent competitive intelligence author, with this phrase and Fleisher further says it takes an ecosystem view of the organizations' markets, customers, competitors, megatrends, and so forth.

Jim Miller, current board of directors member of the Special Libraries Association (SLA) and past member of the SLA competitive intelligence division executive board in explaining where the focus of CI was for SLA members when the competitive intelligence division was formed (in 2007) and where it is going stated "in 2007 the focus for our members was more on the collection side. Then our members moved towards the analysis piece and the future is foresight. Foresight is starting to show itself." The growing importance of foresight within both competitive intelligence associations indicates that to some extent there is overlap or complementarity within both fields.

Competitive Intelligence and its Relationship with Foresight

Each paper in this special issue provides the reader with the author's view of competitive intelligence. However, to give the reader a general definition for the introduction of this special issue, I provide the following. Du Toit [*Du Toit,* 2015] in a review of 338 peer-reviewed papers on CI gathered from ABI-Inform provided the following definition of competitive intelligence

"A process or practice that produces and disseminates actionable intelligence by planning, ethically and legally collecting, processing and analysing information from and about the internal and external or competitive environment in order to help decision-makers in decision-making and to provide a competitive advantage to the enterprise." [*Du Toit,* 2015, p. 15].

Du Toit further defined competitive intelligence in terms of its objective: 'Competitive intelligence (CI) is a strategic tool to facilitate the identification of potential opportunities and threats.' [*Du Toit,* 2013]. Rodriguez-Salvador et al. wrote that the objective of competitive intelligence was to support innovation [*Rodriguez-Salvador et al.,* 2013].

The European Union's European Foresight Platform defines foresight as "a systematic, participatory, future-intelligence-gathering and medium-to-long-term vision-building process aimed at enabling present-day decisions and mobilizing joint actions."[2] Through this definition, foresight and CI are looked at in a sense, as a combined discipline, with foresight involving "future-intelligence-gathering." An integrated programme involving foresight, competitive intelligence and business analytics should not only decrease levels of uncertainty and risk but also lead to greater probabilities of policy uptake by its intended audience and also the early identification of industry opportunities [*Calof et al.,* 2015].

Similarly, the National Research University, Higher School of Economics Institute for Statistical Studies and Economics of Knowledge text mining and seman-

[1] Available at: https://www.scip.org/news/news.asp?id=439063, accessed 30.05.2020.

[2] Available at: http://www.foresight-platform.eu/community/forlearn/what-is-foresight/, accessed 13.06.2020.

tic analysis system which is used for innovation policy research is called iFORA which stands for Intelligent Foresight Analytics (system).[3] This view of competitive intelligence as a complementary and similar to foresight was also described in a *Foresight* journal special issue on North American foresight.[4]

Other research has pointed to competitive intelligence and foresight as not just being complementary and partners but as having significant overlap. There are many similarities between foresight and CI. For example, many of the analytical techniques used in foresight are also used in CI. Also, similar to foresight, CI gets much of the information used from experts outside the organization, secondary sources outside the organization, and combines this with internal information. The gathered information which is then analyzed is then used to support key decisions such as corporate or business strategy decisions, market entry decisions, product development and R&D [*Calof,* 2017, p. 34]. The complementarity of foresight and competitive intelligence has not only been recognized in the academic literature, it has also resulted in the formation of an academic special interest group, the Global Insight Network.[5] Further, the 2020 Competitive and Market Intelligence Conference's academic track was focused on both competitive intelligence and foresight and also brought together foresight and competitive intelligence practitioners.

With academic research linking foresight and competitive intelligence as well as practitioners and CI associations also linking these two fields, this special issue has been designed to provide the *Foresight and STI Governance* community with articles that highlight competitive intelligence scholarship, practice, and teaching. In keeping with the aims of the journal, the selection of topics and papers in this special issue directly contributes to the interaction between researchers, policy makers, and other actors involved in the innovation processes by having articles written by CI researchers (from the academic community), CI practitioners (from both industry and government), and others involved in the competitive intelligence ecosystem.

The articles for this special issue have been written by many of the most respected members of the competitive intelligence community. The special issue starts with an article that looks at competitive intelligence (CI) from the perspective of a competitive intelligence associations. This article focuses on SCIP (Strategic and Competitive Intelligence Professionals), the largest global professional association for CI and the CI division of the Special Libraries Association (SLA).

The Professional Associations View on State-of-Art CI and the Future of CI

Associations have been the subject of extensive academic research that pointed to their important role in the development of relevant industries' ecosystems [*Peters et al.,* 2019]. A 2018 special issue in the *Journal of Management Enquiry* focused on the roles and responsibilities of trade associations [*Lawton, Rajwani,* 2018]. Norqvist et. al [*Norqvist et al,* 2010] looked at the role of associations in terms of "coordinating, developing, and preserving their industries" while Greenwood et al. [*Greenwood et al.,* 2002] looked at how a professional services association helped transform its industry. Rajwani et al. wrote "associations work to influence regulation, government policy, and public opinion on behalf of the collective needs and objectives of their members. They also serve as agents for disseminating and exchanging information within industries, and often act as informal regulators by setting voluntary standards of behavior for industry members." [*Rajwani et al.,* 2015, p. 224]. The importance and role of associations as found in the literature suggests that the association should have a good overview of the field.

Two associations were selected for this special issue — The Strategic and Competitive Intelligence Professionals (SCIP) and the Competitive Intelligence division of the Special Libraries Association (SLA). SCIP is considered the world's largest community of strategic, market and competitive intelligence professionals. The CI division of SLA is the third largest and most rapidly growing division of the Special Library Association. Increasingly, library and information science professionals are embracing CI and enhancing their contributions to their organizations.[6] SLA defines itself as "a non-profit global organization for innovative information professionals and their strategic partners in business, government, academic, and other 'specialized' settings.[7] Members of SCIP and SLA have all possibilities for best practice sharing, professional development, online training and education, networking, and access to world-class resources."

The next section provides information from the associations' websites and from interviews with association leadership. For the SCIP, the interview was held with the Society's executive director (Cam Mackey) and for SLA, the interview was held with Jim Miller, an SLA board member who was part of the CI Division executive board.

Strategic and Competitive Intelligence Professionals (SCIP)

Founded in 1986, SCIP is the largest global association for competitive professionals[8], with an established CI ecosystem and activities that besides competitive intelligence itself, include sales and marketing, market insights and research, business development, product management, innovation, strategy, and analysis. It consolidates competitive and market intelligence professionals, strategy leaders, solutions providers, professors, students, and non-profit experts, with a variety of employment histories.

Over 50% of SCIP members have 7+ years' experience as Intelligence Strategists, 30% are relatively new to the

[3] For more details see.: https://issek.hse.ru/data/2020/05/28/1550143786/iFORA_brochure.pdf, accessed 13.06.2020.

[4] Available at: https://www.emeraldgrouppublishing.com/journal/fs/north-american-foresight, accessed 13.06.2020.

[5] Available at: sprott.carleton.ca/insight, accessed 13.06.2020.

[6] Available at: https://www.sla.org/about-sla/, accessed 30.05.2020.

[7] Available at: https://connect.sla.org/ci/home, accessed 30.05.2020.

[8] Available at: https://www.scip.org/page/About-Us, accessed 30.05.2020.

discipline. By title, 26% are in market insight, 24% competitive intelligence, 21% strategy and analysis, and 8% listed as executives or other Profit and Loss titles.

SCIP serves wide range of industries: Pharmaceutical and Life Sciences, Professional Services, Insurance and Financial, Education, Aero and Defense, Manufacturing, Hi-tech, and Software. The focus is on helping the client organizations grow and the society has termed this "competitive intelligence for growth" (see Table 1).

In the interview, SCIP executive director Cam Mackey stated that CI bridges hindsight and foresight with insight thus preventing "the loudest voice in the room" from driving the decisions. "If we do our job right we can create huge revenue opportunities and actually really reduce strategic risk." To do so requires attention to what Cam refers to as the data supply chain, a core component of creating actionable intelligence. "An equipment manufacturer, for example, has a vast, global supply chain that supplies it with hundreds of components. It spends a great deal of resources to ensure the quality, reliability, and ethical activities of that supply chain. CI needs to do the same, but with the Data Supply Chain.... Data quality and hygiene are often talked about, but as a community we need to do more to ensure that the data we use were collected in an ethical manner. And also that data and our analyses are shared in a transparent and responsible way.

Cam Mackey gives special focus to the SCIP Code of Ethics (see Box 1): "The Code of Ethics provides a true north, but it's (intentionally) not a substitute for internal company's policies. Just as importantly, it's not a substitute for professional and personal integrity. Whether organizations choose to have a centralized function or fragment responsibilities across other functions, effective Growth Intelligence is a strategic advantage. Without it, companies fly blind when making critical growth, strategic, and investment decisions".

In the early days, CI was focused more on understanding and predicting competitor behavior with an emphasis upon collection activities. In 2016, Nan Bulger, SCIP's executive director (Cam Mackey's predecessor) described where CI had been and how it was evolving. "About 30 years ago, competitive intelligence focused primarily on the competitor, as a means of placing that competitor focus at the center of your decisions and understanding the competitive landscape, understanding what competitors were doing to compete, collecting data about competitors in the form of human-source collection, as well as secondary or printed-source collection… now it's really evolved into sophisticated decision support and analytics. It involves looking at competition, market environment, market sizing, and so forth for the purpose of really helping people understand how best to compete in a market" [*Calof,* 2016]. Nan Bulger called this new approach integrated intelligence.

In looking at both the skill set for the future and the impact upon the profession of artificial intelligence, Cam Mackey sees a further evolution in CI in the context of integrating across functions and the skill set of tomorrow's CI professional being more in analysis, developing insight, and becoming a more effective communicator of these insights to decision-makers. "It's an obvious point, but to be successful in the modern organization, you have to be cross-functional. It's less about our ability to collect and hoard data than ability to quickly pull out the insight and get it to the right person at the right time. Our power isn't in our controlling access to information. It's using that information with integrity to help our organizations reach their goals…Artificial Intelligence and the whole suite of data analytics tools have and will continue to transform our profession. However, it would be a mistake to assume that we'll be rendered obsolete by machines. Rather, the human element has never been more important for CI. As key elements of our process become streamlined or automated thanks to technology, there's an enormous opportunity, and obligation, to innovate in how we translate data (and analyses) into something that your organization will value. Much of that comes down to effective communication, at all stages of the process."

As to membership benefits, Cam McKee states: "People belong to an association to feel a sense of fellowship, to be part of a community of practice. But sometimes, they just want what I call "air support." They want best prac-

Table 1. **SCIP's Principles of Intelligence for Growth**

Approach	Description
360-Degree View	Growth Intelligence takes an ecosystem view of an organization: markets, customers, competitors, megatrends, etc. It also bridges hindsight and foresight with insight
Filter Out the Noise	We are awash in information. Intelligence Strategists reduce the sea of data to critical insights that inform decisions to drive growth and de-risk strategies
Evidence-Based	Intelligence Strategists use a variety of tools and techniques to expose frailties in strategies and value propositions (even if that leads to uncomfortable conversations with management)
Element of Surprise	Growth Intelligence can help an organization disrupt markets and win market share. Without it, organizations may miss warning signs and be blindsided
Organizationally Aligned	Intelligence Strategists support numerous stakeholders (e.g. sales, strategy, marketing, product management, etc.) in the growth value chain
Just in Time	By leveraging outstanding communication skills and technology, Intelligence Strategists deliver the right insight to the right person at the right time
Unimpeachable Ethics	Growth Intelligence is grounded in the ethical collection and use of information (see our Code of Ethics for more)

Source: SCIP website. Available at: https://www.scip.org/page/CI-MI-Basics-Topic-Hub, accessed 15.06.2020.

Box 1. The SCIP Code of Ethics

Our Code of Ethics is the industry standard set of guidelines for ethical behavior for competitive and market intelligence activities. We expect our members, partners, staff, and the entire community to adhere to the Code, without exception. The Code is not a corporate policy; it contains guidelines by which companies and practitioners can set their own standards along the ethical spectrum.

- Elevate the Profession: To continually strive to increase the recognition and respect of the profession
- Always in Compliance: To comply with all applicable laws, domestic and international
- Transparent: To accurately disclose all relevant information, including one's identity and organization, prior to all interviews
- Conflict-Free: To avoid conflicts of interest in fulfilling one's duties
- Honest: To provide honest and realistic recommendations and conclusions in the execution of one's duties
- Act as an Ambassador: To promote this Code of Ethics within one's company, with third-party contractors and within the entire profession
- Strategically Aligned: To faithfully adhere to and abide by one's company policies, objectives and guidelines

We reserve the right to revoke and terminate any membership at any time if we determine that a member's activities are in direct violation of the Code of Ethics.

Source: SCIP website. Available at: https://www.scip.org/page/Ethical-Intelligence, accessed 15.06.2020.

tices and help doing their job better. They want someone to help elevate the brand of the function or the discipline of their profession. That's certainly the case with our community."

In defining how SCIP in particular provides benefits to its members, the website highlights several activities including[9],[10]:

- being part of a community,
- attending the world's largest non-profit conference for intelligence strategists (SCIP IntelliCon),
- access to extensive online resource archives (1,000+ articles, research papers, case studies),
- access to CI training (virtual workshops, webinars, on-demand training, in-person workshops),
- networking with peers (including access to an online members directory, chapters, online community, virtual roundtables),
- access to talent and jobs (career center),
- high ethical standards (through the SCIP code of ethics, the violation of which can result in the expulsion of a member),
- access to service providers (including technology service providers as well as research and strategy needs),
- variety of free guidebooks on how to start CI Function, CI Ethics, Event Intelligence, and Market Intelligence/CI

Special Libraries Association (SLA)

The SLA (the Special Libraries Association) was established in1990 by a group of librarians who noted an increase in librarians working in more specialized settings (for example in corporations, government agencies, scientific organizations). In 2007 with growth in the number of SLA members (including librarians and other information professionals) involved in competitive intelligence, the CI division was formed.[11]

According to Jim Miller, this has arisen due to changes to libraries in general and more specifically transformations in the role of information professionals: "More and more organizations are reducing their corporate information centers and pushing the people from these centers into other parts of the organization and the SLA CI skill set has more defined value than someone who is just finding information…. The phasing out of traditional libraries and corporate information centres has led to a growth in the number of people transitioning to CI roles to provide more value-add for business."

The SLA CI Division defines Competitive intelligence (CI) as "a vital managerial process and activity that examines the external environment to support strategic AND tactical decision-making. Typically, it is not limited to researching competitor companies. Organizations examine their markets, customers, suppliers and so forth. All those aspects contribute to understanding one's competitive environment. Since comparison is involved, often there is great overlap with Knowledge Management to "know thyself" as well…

SLA members established the Competitive Intelligence Division in January 2007 to create a professional community that encompasses all aspects of this dynamic and essential organizational function. This includes planning, identifying intelligence needs, collecting and analyzing information, and providing strategic and tactical decision-support to management… We are comprised of information and intelligence professionals from a broad range of industries, organizations, and roles."[12]

The description provided by the CI SLA division fits well with the definition of CI provided earlier in this article that incorporates a CI process which includes planning,

[9] Available at: https://www.scip.org/page/Membership-Value, accessed 30.05.2020.

[10] Available at: https://www.scip.org/page/Membership-Top-10-Tips, accessed 30.05.2020.

[11] Available at: https://connect.sla.org/ci/home, accessed 30.05.2020.

[12] Available at: https://connect.sla.org/ci/home, accessed 30.05.2020.

Table 2. **SLA CI Division Functions, Responsibilities, and Examples**

Examples of the members	• Information professionals interested in enhancing their reference research background and/or analytical skills • Knowledge/Record Managers building on internal benchmarking/content management backgrounds • Corporate/Government Librarians whose work contributes to their organizations through timely, authoritative, delivery of insights with the depth/breadth/focus needed to succeed • MBA/Analysts and Journalists seeking to enhance their investigative abilities • Academics supporting professorial research and/or institutional fundraising • Independent Consultants offering secondary searches, etc. • Primary Market Researchers • Patent Due Diligence Specialists
Member functions/ responsibilities	• Administrative / Management / Supervisory • Business Development / Prospecting • CEO, President, Founder or other leadership roles • Collection Development / Resource Selection • Compliance • Consulting • Data / Statistics • Information Architecture • Journalist / Writer • Knowledge Management / Intellectual Property • Project / Program Management • Records Management / Archivist • Reference & Research • Retired • Sales / Account Management • Student • Taxonomy / Metadata / Cataloging • Teaching / Training • Technical Services • Transitioning / Job Seekers • Webmasters / Emerging Technologies / IT / Systems

Source: SLA Website. Available at: https://connect.sla.org/ci/communication/new-item1541, accessed 15.06.2020.

collecting information, analysis, and communications focused on the external environment for helping with tactical and strategic decisions. However, within this definition of competitive intelligence Jim Miller talked about their members being focused more on the collection and collection planning functions: "SLA is an organization where the majority of the members are librarians, library science, so how we better collect information and provide valuable intelligence that starts at the beginning of the process — research patent searching, process of looking of what has gone on before, lit review and a lot of secondary sources. We see members involved in patent searching for new product development, members in research units for technical intelligence and other areas. A lot of the SLA CI division members have been trained to ask the right questions to fully understand what are people asking for. They have a librarian skill set, search set, the ability to develop sophisticated search strings to get all sorts of information. Some of our members do this from an MBA background, others from a Library Science background.

The core skill set for these members based on a review of the SLA divisions programs and the interview with Jim Miller appears to be information searching, research planning, and source reliability assessment. The emphasis upon the collection side (including collection planning) of those that are part of SLA's CI division was also evident when Mr. Miller contrasted division members with SCIP members: "Most of our members are also SCIP members. However, finding the right information to put into the process is where our members are focused. For SCIP, CI is more focused on information from primary sources. For SLA, it is more focused on secondary information sources but there are people in SLA pushing into primary sources and interviewing".

Mr. Miller's description of the skill set and the focus of what SLA CI division members focus on fits with Cam Mackey's description of the data and information value chain mentioned earlier. As such, it positions this division as a key component of the CI ecosystem in terms of the early part of the value chain. This was further reinforced in the interview with Jim Miller: "We are pushing from our side telling the members to get involved earlier, to get involved early in your senior managers' processes". Thus, in contrasting membership of the SCIP and the SLA CI division, it would appear that SCIP represents the breadth of the data and information value chain while the SLA CI division is more focused on the early stage of this value chain.

The SLA CI division website provides a representative (not comprehensive) list of member function/responsibilities and examples of what their members do. This is provided in Table 2.

Similar to the discussion with Cam Mackey at SCIP, Jim Miller pointed to changes in his members' environment including artificial intelligence that is pushing their members to provide higher value added within their organizations. "In 2007 our members were focused more on the collection side. Our members are now moving towards the analysis piece and the future is foresight. If you talk to the practitioners, they are integrating strategic foresight methodologies to their work." The transition from a traditional role in collection to analysis and foresight has according to Mr. Miller arisen due to changes with their members' organizations and/or with their clients. "Corporations want to turn to people who will do interpretation, who understand the business and the goals. Not just collection but also interpretation... The trends analysis piece is also becoming bigger for our

members' organizations they are getting involved in forward planning activities".

Artificial intelligence is another area that is providing opportunity for SLA CI division members and is fueling division growth. . Jim Miller stipulates that this is arising due to the SLA CI division members' skill sets, which are well suited for the challenges of AI and analytics. "For AI and sentiment analysis to be used effectively you need professionals who understand the context of the information, who understand keyword concepts, and collection planning. This is part of the SLA CI division member toolset".

Miller also points to other factors that suggest continued growth in the SLA CI division:

1) There will continue to be graduates in information and library science programs but there will be fewer jobs in traditional public libraries. In looking at where the CI division will be in ten years' time "it will be a bigger division focused more on how people with Library Science degrees can use their skill set other than just in a public library."
2) The rapid growth of the SLA CI division and a diversified membership base is partially a function of the growth of CI and CI-related areas but also significant changes in libraries and the role of information professionals. "More and more organizations are reducing their corporate information centers and pushing the people from these centers into other parts of the organization and the SLA CI skill set has more defined value than someone who is just finding information… The phasing out of traditional libraries and corporate information centres has lead to a growth in the number of people transitioning to CI roles to provide more value-add for business."
3) "The fact that CI cuts across numerous sectors allows for a wider pool of potential members. As well, the emerging growth of the application of CI in certain sectors such as regional economic development has allowed for and will continue to fuel increased growth in membership and collaboration with other communities for example pharmaceutical, military, and legal."

While the above explains both the rapid growth of the SLA CI division and its projections for continued growth, Mr. Miller does acknowledge that for its members "the primary focus is still on where is the best source for information and how to get it."

Similar to both the association literature and the discussions with SCIP, SLA CI division provides numerous benefits and programs to its members. Jim Miller says, in summary, the following: "The SLA CI Division provides its members with: networking opportunities; access to professional development webinars; access to CI presentations at annual conference; access to resource locators to find information that is useful for CI data collection (primarily secondary); mentoring opportunities for those taking intelligence/librarian education in post-secondary institutions… It helps to demonstrate that there are other career/employment opportunities for individuals with librarian/information management skills that go beyond the traditional librarian role of simply searching for information."

The SLA CI divisions website provides additional details in terms of the benefits of being part of the society.

"Membership also provides many opportunities for professional growth and development, and we are glad to collaborate along the way. That includes continuing educational programs — virtual and site-based, professional support for intelligence efforts, as well as many more resources."

Conclusion

This article sets the context for the competitive intelligence special issue. Interviews with leadership from two competitive intelligence associations (SCIP and SLA CI division) provide readers with an overview of how they define competitive intelligence and its role in organizations as well as how they see CI changing in the future. Within both organizations the emphasis in the evolution of their members' activities has been to move beyond collection activities only focused on the competition into more value-added activities including analysis and looking at broader environmental elements (customers, government, technology, economy, etc.). Both see artificial intelligence as being transformative and beneficial to their members. The overlap between competitive intelligence and foresight was also highlighted by both associations who indicated that their members are getting more involved in foresight activities.

With future-oriented, information/value-added value chain activities growing in importance due to changes in the underlying competitive environment, both societies see the opportunity for continued growth for their organizations as well the emergence of related associations that focus on other aspects of the competitive intelligence environment. Cam Mackey mentioned the Insights Association as one such example. Both also noted that the diversity of their membership results in titles that are not just called "competitive intelligence" but also market insight, market research, strategy, analytics, and more suggesting that the skill set that underlies the competitive intelligence professional is now being seen as a requirement in many related areas.

The rest of the papers in this special issue focus on giving readers insight into CI practice, research, and education.

The first article, "Intelligent Technology Scanning — Aims, Content, and Practice" written by Dr. Brad Ashton, provides readers with an overview on technology intelligence (TI) and how it is developed, a primer on TI. The article leads the reader through the phases of the technical intelligence cycle: needs assessment, TI collection and processing, analysis and synthesis, production, and reporting, delivery and feedback. Dr. Ashton identifies the kinds of decisions that are made based on technical intelligence, the sources of information that are typically sought out and the analysis techniques that are used. The overlap between foresight and intelligence is particularly evident in this article in the analysis and synthesis section. Techniques described include foresight studies, scenarios analysis, scientometrics, disruptive technology assessments, patent analysis, literature mapping and bibliometrics. The article concludes with a comprehensive case study that leads the reader through the phases of the TI cycle.

The next article by Nisha Sewdass and Jonathan Calof provides an overview into competitive intelligence. Sewdass and Calof report on a study conducted on SCIP (Strategic and Competitive Intelligence) members that examine how competitive intelligence practitioners define and operationalize/practice competitive intelligence. The comprehensive survey confirmed CI as a multidimensional concept involving planning collection, analysis, communication, and management activities. Only 29% of intelligence project time is involved collection activities. This article describes organizational requirements for competitive intelligence.

The following two works explore the role of competitive intelligence in innovation. In his article "Mapping Technology Landscape to Accelerate Innovation", Dr. Paap describes how competitive technical intelligence (CTI) can be used to help organizations "enhance their innovation efforts." The author describes science and technology intelligence (STI) and how it differs from competitive technical intelligence (CTI). The article contains many examples of CTI practice and lays out a framework for the effective development of CTI including detailed descriptions of key CTI tools. Dr. Paap concludes: "The reason why Competitive Technical Intelligence (CTI) is so critical is based on the understanding that innovation starts with information, not ideas. Thus, organizations that desire to be more innovative need to spend significant time on efforts to gather and assess information as a prelude to idea screening and selection and continue to look for changes that might affect project success throughout the execution phase. CTI provides a structured approach to anticipate the future and acquire the information required to generate innovative ideas and effectively manage their development".

The Mancilla-de-la Cruz et al. article "Scanning Additive Technologies for Competitiveness in the Pharmaceutical Industry" shows how competitive technical intelligence can be used for making R&D decisions. This article reports on the use of multiple analytical techniques including hype cycle, multiple linear regression analysis using scientific documents and patents from SCOPUS and PatSnap to identify additive manufacturing (AM) based investments for reconfiguring drug delivery systems. The paper uses multiple CTI techniques which collectively identifies the "evolution of new drug delivery products where additive manufacturing is present." The techniques used by the authors identify the AM technologies that have the highest impact and for which R&D investment may be warranted. Where the Ashton and the Paap articles provide useful overviews with many examples, this article provides a single in-depth application example using advanced analytical CTI techniques thereby showing the reader how CTI can lead to better decisions.

Marie-Luce Kuhn et al's article "Business Anticipatory Ecosystem Outside the "First World": Competitive Intelligence in South Africa" provides readers with a look at what defines a competitive intelligence ecosystem, its components, and how these components are measured. While most CI articles focus only on practitioners and how CI is practiced, the ecosystem concept notes that CI practice depends upon having an appropriate ecosystem to support organizations. Examples of the components of this ecosystem include:

- Service providers (consultants for example) that assist organizations in their CI activities;
- Universities that provide trained students (employees), conduct training programs for the existing employees and research that informs practice;
- Associations that provide among other things training and professional standards.
- Companies (private sector, government, NGOs) who practice CI as part of their ongoing business activities.

The article describes the components of the CI business ecosystem, measures to identify development within each component of the CI business ecosystem and then uses these measures to describe the CI business ecosystem in South Africa. The authors identify several weaknesses in the ecosystem especially at the association and consultant level and strengths in terms of firm level practice which was found to be more advanced than other firms in Africa and significant growth in academic involvement in competitive intelligence.

The article "Changing Priorities for Strategic Planning from National to Territorial Levels" by Henri Dou et al. shows readers the importance of applying competitive intelligence not just at the organizational level (to help companies) but at a regional and national level. The article focuses on how, by using competitive and strategic intelligence, it is possible to anticipate global changes and better manage a region during major global changes such as the current COVID-19 coronavirus crisis. The authors write: "It is in this context that a new Competitive and Strategic Intelligence must be developed to analyze the constraints, stresses, and unexpected threats that will impact communities. It must contribute to building local resilience allowing an acceptable response to the "predicament" and helping to create a new and ethical governance."

Foresight practitioners and researchers will appreciate the focus of the article on the territorial level, the tools of Competitive and Strategic Intelligence require the integration of what is termed "local actors". In particular, synergies between the actors, the complementarity of skills, and consensus need to be sought out in order to collectively pursue the results identified by the competitive and strategic intelligence process.

The final article by Leonardo Garcia, "Strategic Intelligence Teaching to Leverage Professional Success" provides readers with information on how competitive intelligence is taught to undergraduate students. It describes the projects assigned to students and the knowledge, skills, and attitudes that form the core of the author's university competitive intelligence program. The student's perceptions of how each of these knowledge, skills and attitude areas can impact their future professional success is provided with most respondents indicating that despite their not intending to pursue a CI career, they see how the skills, knowledge, and attitudes can have a positive impact upon any career.

I end this introductory article with a profound thank you to all those who submitted articles to this special issue. *Foresight and STI Governance* readers we hope will appreciate the mix of articles written by academics and practitioners, providing readers with a broad perspective on both the theory and application of competitive intelligence. Most of the articles are from authors who

have been the recipients of various awards in recognition of their contributions to competitive intelligence. The fellow designation is awarded to those who are recognized in the field as leaders in competitive intelligence practice or scholarship are at the top of their field. Perhaps the strength of the authors for the special issue is reflected in the following review "incident." The reviewer appropriately noted that the description of an intelligence application within a major multinational in the paper was not the same as had been described in both the popular press and the academic literature. The author responded with "I know it's not the same, but I was the practitioner that ran that application in the multinational." To put it bluntly, in assembling this special issue, readers in many cases are hearing from the proverbial "horse's mouth", those that have been at the center of CI practice and research. We hope that providing a wide breadth of articles on various aspects of competitive intelligence from some of the top practitioners and researchers in the field will help *Foresight and STI Governance* readers learn and gain insight into this foresight-related field.

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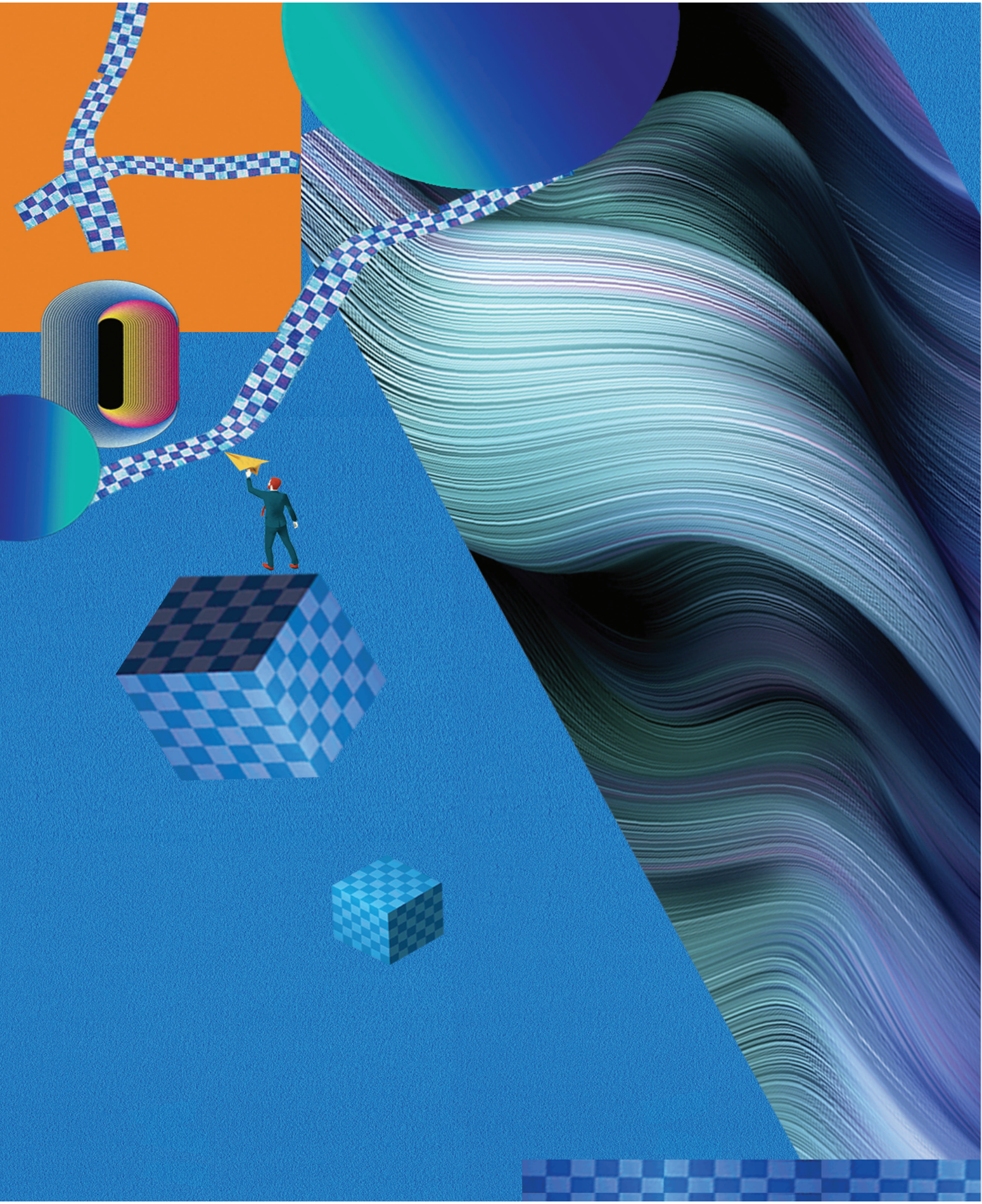

Intelligent Technology Scanning: Aims, Content, and Practice

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Abstract

In business or government operations, surprise is rarely a good thing. Although sometimes positive, the effects of unexpected events and developments can take a variety of difficult forms — from being simply inconvenient to disastrous. However, foreseeing the future accurately is a difficult process, especially futures that involve dealing with emerging technologies. Further, unexpected new technology developments can produce significant surprises.

The main response to this uncertainty is to establish early warning systems that help anticipate technological surprises. However, many specific internal company early warning efforts set up to anticipate technological surprises are often not effective. Even when successful, early warning alerts can end up not being enough. Not only are responsive actions by managers essential to dealing with potential surprises, but real benefits can occur when a future technology warning is turned into a company advantage through deliberate actions that arise from the warning process. Incorporating the full set of technology intelligence (TI) practices is an important element of creating a business edge by managing and potentially exploiting surprises.

This paper provides an overview of technology intelligence (TI) as practiced by many organizations today, from the private, government, and international sectors. The discussion begins with describing TI objectives and the TI process and then presents several elements of how TI operations are conducted by focusing on TI customers, descriptions of TI needs, and how to address them.

Keywords: technology intelligence; technology; innovation; competitive intelligence; business analytics; competitive advantage; SWOT analysis

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Technology Intelligence Tasks

All companies apply some form of technology — for product design and testing, manufacturing and production, information and communication, materials and product delivery, and research and development. "Technology" generally refers to the methods, skills, systems, and devices that apply scientific knowledge for practical purposes to improve capabilities, performance, or lower cost. Technologies enable the processes by which an organization transforms labor, capital, materials, and information into products and services of greater value. Naturally, computer and information improvements have technology at their core. Even a retailer like Sears uses its own particular technology to procure, present, sell, and deliver products to its customers, while a discount warehouse retailer like Walmart employs a different set of technologies. The concept of technology even extends beyond manufacturing and engineering to encompass a range of marketing, investment, and managerial processes.

Exploding Information

Along with business and market data, science and technology (S&T) information is increasingly important to business and is increasingly prevalent and accessible worldwide. The size, variety, and pace of new technology information available today is difficult to track and understand, especially considering hidden sources like the "deep" and "dark" web. This expanding resource leads to important difficulties in using current information, such as: information overload, unclear accuracy (the reliability of information and the sources from which it comes are often not known), and, consequently, rising search frustration.

Information is the currency of business operations, but the exploding, dynamic, and complex information environment often makes it difficult to find what you want, when you want it, in the format you need, and at the confidence level you require to use it, which can also lead to technological surprises. As John Naisbitt (1982) stated some time ago, "*We are drowning in information but starved for knowledge*" [*Naisbitt,* 1982]. A fundamental response to this situation is to build and apply technology intelligence (TI) systems.

These systems are a specialized version of competitive intelligence (CI) practices [*Calof et al.,* 2010, 2015] with a focus on technological issues. TI addresses organizational needs for technology information — to identify the technological opportunities, threats, and situations that could impact the survival of the company and future business growth. TI aims to capture, interpret, and disseminate the technological information needed within an organization to support strategic planning, investments, and operations. TI provides results that serve as insurance to help ensure that any organization stays competitive.

Technology Intelligence (TI) Defined

Most TI "best practice" firms have a shared, widely understood definition of TI that is captured using basic concepts such as:

> TI is analytical information about external scientific or technological activities, developments or organizations that have the potential to affect an establishment's short- or long-term competitive situation [*Ashton, Klavans*, 1997].

TI is a special form of information; it is created by collecting, processing, and analyzing raw data — intelligence is not simply "collected." Like CI, the TI process begins with a collection plan, gathers input data, validates, and then evaluates these data to produce intelligence results and findings. Although TI inputs are expected to be obtained using legal and ethical methods, employing these practices is not always the case, as in for example industrial espionage, insider trading, or "information swapping". This paper reinforces legal and ethical practices that are implemented to address established consumer "intelligence needs" or questions in a current, timely, and appropriate way. Effective TI can be described as:

- Analytical — It has been processed, interpreted, and validated as accurate
- Actionable — It answers the question, "So What?" (Is the intelligence useful and why?)
- Protected — It is controlled to prevent inadvertent disclosure

For a perspective on TI that is based on everyday experience, TI actions and procedures can be understood by considering their similarity to several analogous actions, as shown in Table 1. Building on what is meant by TI, Table 1 also informs on what TI is NOT.

As an example, to illustrate intelligence concepts, Table 2 shows two descriptions of a company report on recent market activity. They illustrate the company response to a market situation.

With more detail and insights in the report, it should be clear that the second response is the superior one. The strength of intelligence reports is that they include components for a timely, effective, and focused response: custom-tailored reports for multiple users, possible early warning, identified and verified sources, explicit interpretation and action recommendations [*Fleisher, Ashton,* 2009]. This points to the fundamental principle that intelligence is "deliberately produced, not just collected."

Effective TI Is a Force Multiplier

TI products can reveal significant technical and business opportunities for an enterprise, but the effort must be well-organized, use effective means to gather and analyze information, and convey the intelligence to customers who can act upon it by employing trained individuals with experience, skills, and the right temperament. Many companies operate ongoing TI efforts

and gain multiple types of advantages for their business [*Manzini, Mariotti,* 2009]. The comprehensive published literature covering TI contains numerous valuable resources to enhance knowledge of current practices and benefits. For example, Shell Oil Company uses TI in their strategic business planning [*Narajulah,* 2009] and Daimler Benz Aerospace has successfully used scenario analysis and early warning [*Tessun,* 2007]. Other companies are highlighted in [*Norling et al.,* 2000] of DuPont, including Motorola, SmithKline Beecham, Clorox, and Baxter Health Care. TI is also used as part of company R&D efforts as described for 3M and Proctor and Gamble [*Buzzanga,* 2008] and, increasingly, companies integrate TI into their efforts to implement open innovation [*Veugelers et al.,* 2010].

TI also includes the growing business practice of technology scouting (TS), which refers to systematically searching and/or partnering to identify attractive external technologies that can be acquired to improve a firm's operations and competitive position. Deutsche Telekom has been active in technology scouting for many years and this has led numerous new technologies of interest [*Rohrbeck et al.,* 2007]. Technology scouting has become a valuable element of an open innovation approach to new technology acquisition, among other applications, for a variety of technology-based firms. The value lies in both strengthening current businesses and identifying future growth opportunities. Successful in-house technology scouting programs, where companies have identified and exploited specific external technologies, include firms such as Northrop Grumman, Dow Chemical, Saudi Aramco Energy Ventures, W.L. Gore & Associates, Vulcan Labs, and the National Science Foundation's Small Business Innovation Research (SBIR) program.[1] For example, the Owens Corning Front End of Innovation Group identified and pursued external technologies in the advanced materials areas such as polymer modified asphalt, smart materials, binders, and 3-D polymers. Within 18 months, this effort eventually led to the development of XSTRAND, a high performance 3-D printable platform, with commercial grade sales in Q2 2017.[2]

TI Needs in Industry and Government

All forms of intelligence begin with an understanding of customer needs for intelligence — what information customers require about their environment, current position, and/or future prospects. Commercial and government customers alike have both common and unique intelligence needs concerning current and emerging technologies. The TI needs of these customers concern topics for which accurate, timely, and validated information is important. Intelligence needs can cover a wide range of technology-related topics including competitor's technology status along with progress on emerging technologies and, more generally, public and private R&D funding for advanced development and imported manufacturing methods by industry players.

Specifying Intelligence Needs

Above all, the time horizon for intelligence needs must be clarified, as appropriate, to cover both short-term purposes (days or weeks) and also long-term requirements (weeks, months, or even longer). The short-term focus covers situations where, say, a new product announcement is expected within weeks, while longer-term needs would arise when a new, faster production investment is being made for implementation after development work over the next few months or years.

Then, the level and scope of particular TI needs can also vary — from tactical needs with limited, focused scope, such as assessing the factory production cost for current production systems, to more high-level strategic/general needs, such as understanding the market impact of large-scale technology investments over many competitor manufacturing locations.

Types of TI Needs

Technology intelligence needs involve technology-related topics, including technology organizations and government S&T programs. Several typical types of needs for current and accurate intelligence, which can be either general or specific depending on the circumstances, are described in Table 3.

TI Applications and Products

There are three broad objectives for TI efforts and more specific example TI applications that are shown in Table 4. Many more specific applications have been carried out using TI (see for example [*Ashton, Stacey,* 1995; *Ashton, Klavans,* 1997; *Mortara et al.,* 2010; *Manzini, Nasullaev,* 2017].

Table 1. **Activities Related and Unrelated to TI**

Related activities	• Journalism — Investigative reporting • Law enforcement — Detective work • Scientific research — Creating/finding new fundamental knowledge (theories, principles) about the world • Gaming — Figuring out the angle to win at competitive contests • Puzzles — Completing difficult puzzles rapidly
Unrelated activities	• Spying • Simple database searches • Rumors/ propaganda found on the internet • Speculative news stories • A crystal ball • Found in software packages alone
Source: author..	

[1] http://lanode.org/technology-scouting-workshop-2016/technology-scouting-workshop-speakers/

[2] https://www.marketwatch.com/press-release/owens-corning-to-showcase-the-power-of-composites-to-make-impossible-things-at-jec-world-2018-2018-03-05

Table 2. **Company Responses to a Market News Situation**

Background news item	*Company A is about to release a new process automation product in two months that is aimed at competing on our target markets. Early reaction has been that industry observers speculate it will "revolutionize" the market*
"Information" report	
Recipient	Product manager of Company B
Form of communication	Phone call, verbal/ meeting, memo
Contents	Company A is about to release a new automation product in two months. Early reports by industry experts is that it will revolutionize the market.
Response	It could be a serious threat to us — we need to call a meeting and decide how to respond to this problem!
"Intelligence" report	
Recipient	Product manager (and others) of Company B
Form of communication	Short one-page "alert" message/report
Observation (the data):	Company A is about to release a new product platform — possibly in six to eight weeks (source: news report, contacts)
Interpretation (what the data means):	Preliminary performance data (network contacts) indicate that the new product could disrupt current markets and draw existing customers away from B within three months of release.
Recommendation/ Action (what should be done?)	Respond! Call a meeting of R&D, engineering, marketing, etc. to develop a game plan. Options to consider: a) retreat and launch R&D to leapfrog or improve upon As product with upgrades, b) beef up advertising and compete as long as we can before an exit, c) other options

Source: author.

TI products fall into one of two basic groups: on the one hand, *routine* or regular outputs, often on a preset schedule, and on the other hand, *specialized* products (usually developed on an as-needed basis) addressing specific unique needs with appropriate data and methods of analysis. Examples of both groups are presented in Table 5.

Many TI suppliers have used a structured format to organize findings and back-up evidence. This arrangement of information works well for long TI products or for short one-page deliverables. The format should include a range of topics as shown in Table 6.

The TI Process — How Does the Intelligence Cycle Work?

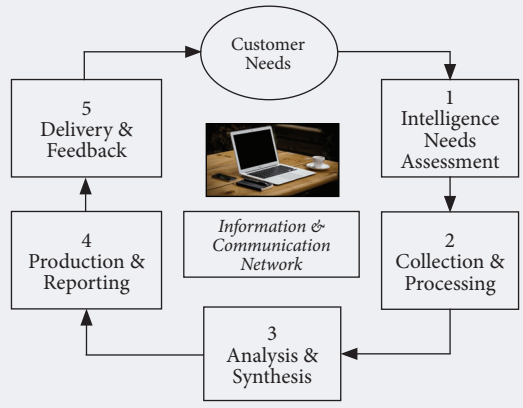
The main steps to gather, evaluate, and produce intelligence comprise the Intelligence Cycle. Many articles describe the basic activities in the process of preparing competitive and technology intelligence (e.g. [*Ashton, Klavans,* 1997; *Brenner,* 2009; *Mortar et al.,* 2010, *Manzini, Nasullaev,* 2017]. As shown in Figure 1, the process usually includes five inter-related steps to add value to original inputs and create a substantially transformed product. The overall purpose of this process is for the intelligence service to provide customers/decision makers with "products" containing insights that assist them in understanding their environment along with insights on the threats, opportunities, and developments it contains. Although the process is multidimensional and multidirectional, the steps form a feedback loop which is implemented in an interactive and iterative manner. Figure 1 indicates that the TI process loop is closed so that the Delivery and Feedback step satisfies the Customer Needs that initially drove the process. All steps rely upon an organized information, storage, analysis, and communication system that is linked to all the relevant parties in the organization.

Step 1: Customer TI Needs Assessment

All good intelligence efforts begin with the formulation of a basic *intelligence problem or scenario* to focus the TI work on important and urgent matters. Intelligence needs are more focused and describe key elements of the intelligence problem. Needs can be expressed by questions such as:

- What are our competitors doing to maintain an edge on the market?
- What kind of equipment was being used on their production line and does it perform better than ours?

Figure 1. **TI Process Steps**



Source: author.

Table 3. **Types of TI Needs**

Field	Description
Science	Identify and track new fundamental knowledge, potential new players/ capabilities or possible breakthrough developments, such as new drug compounds being developed by pharmaceutical companies
Technology	Assess current production system equipment use, emerging technology development progress, potential disruptive products, new approaches or applications
Organizations/ Companies	Identify key new players, assess their roles (competitor, partner) capabilities, plans, and intentions, assess how their technology performs, its costs, and the status of ongoing improvements
Business Sector (Market/ Industry)	Assess current/future growth prospects for new niche technology markets or key player partnerships
S&T Strategic Issues	Understand government regulations, public trade/S&T policies, funding levels, or market attitudes toward S&T

Source: author.

- Where are the competitor's plants located?
- How quickly did the competitor turn out their product?
- What are the potential threats and opportunities on this market that staff should uncover in time to respond?

These and other concerns will drive specific TI collection and analysis efforts.

KITs

Many organizations identify management's intelligence needs by applying a widely used Key Intelligence Topics (KIT) process and related Key Intelligence Questions (KIQs) [*Herring*, 1999].

KITs are analytical statements of information needs that identify what content intelligence should provide to organization customers for them to be effective. KITs tend to be long-standing analytically based business and technology concerns. KIQs are specific, usually near-term questions from a specific internal customer or group that can be answered by a directed intelligence operation (collection, analysis, and delivery) — a current, usually high priority intelligence requirement.

TI needs can be organized into three main categories (Table 7).

Examples of these CI KITs can be found in [*Herring*, 1999] where their use is also discussed. TI staff use the KITs as an essential input to the design of intelligence requirements and collection and analysis plans. In addition, this information enables the identification of the guidelines and methods for the successful dissemination and communication of the intelligence findings to the customers, helping them prepare follow-on actions.

KITs are identified during TI staff interviews with company leaders as well as from documented organization strategy and design and operating practices. They are then documented carefully to ensure agreement among key players and they are reviewed and updated as needed. KITs are a shared responsibility between the customer and the intelligence staff. The interactive dialogues undertaken to identify them provide the focus needed to plan and conduct effective intelligence operations, while permitting CI program designers and managers to determine the resources required to address the company's actual intelligence needs. Best practice TI activities include the following practices for customer needs interviews:

Table 4. **TI Objectives**

Objective	Description
1. Provide Surveillance — Awareness and Early Warning:	Deliver regular updates and "heads up" alerts for upcoming external events or trends, identify and track new technologies, innovations, and organizations, and then assess: • Threats • Opportunities • Current and future trends
2. Deliver Support for Operating Decisions and Actions	Ensure customers get needed day-to-day competitive technology information. *Internal Product and Process Development* • Assess R&D Technical Approaches • Review Investment Options • Accelerate New Product Development • Focus on Commercial Market Plans *External Organization Postures and Potential Moves* • Identify Business Partnerships • Conduct Merger / Acquisition Due Diligence
3. Help Implement Strategy Development and Planning	Provide planners with long term situation assessments and forecasts, suggesting: **ion.** • Competitive Initiatives • New Market or Customer Strategies

Source: author.

Table 5. **TI Products**

Example product	Description
Regular	
Current Alert message	Heads up" message on current events having immediate and serious impacts that require action
Technical Newsletter report	Periodic analytical summaries of current technical topics, e.g. an emerging technology
Trip or Contact reports	Summary highlights of key findings, results from business or technical discussions
Comprehensive Assessments	In-depth analysis of a major S&T topic (e.g. competitor long term product investment or an emerging technology capability from a university research program)
Periodic Trade Fairs or Conference Monitoring	Check for developments during key events.
Specialized	
Situation analysis	Snapshot evaluation of external developments with potential positive or negative implications; e.g. a new regulation or emerging technology
Strategic Forecasts	Analytical projection of key trends or events (e.g., the growing size of an emerging market niche)

Source: author.

- Conduct interviews face-to-face, if possible
- Use two interviewers — to be sure not to miss anything
- Structure the interview topics and scheduled time including: need description; scope and depth of detail; timing; type of activity desired to fill the need
- Remember — customers do not always KNOW their own intelligence needs; needs may require identification through business or technology concerns expressed by the interviewee or external viewpoints
- KITs are dynamic — they may change and should be updated
- Go back to the customer to close the loop during the intelligence operation in case changes or adjustments are needed.

Convert User Needs into Intelligence Requirements

Intelligence needs are typically expressed as desired information by customers in a particular format and on an expressed timeline. This provides a basis for the specifying the practical intelligence requirements for data sources and content that can be addressed in formalized information collection and analysis plans. Employing a structured approach can help the players avoid inefficiencies and take the first step toward generating clear intelligence requirements by defining both the intelligence problem and the requisite components to its solution. A dialogue about the "Five Ws plus One" — Who, What, When, Where, and Why and How — is a good starting point. Clarifying these issues helps to define the intelligence problem, which is the heart of customer needs. Clarifying these helps one prepare for the next step in the process — developing collection and analysis requirements and plans. In both government and business, these questions form the basic framework for decision makers and TI practitioners to follow in order to create intelligence requirements and devise a strategy to address them.

To understand TI and its component activities, we begin by explaining what TI is designed to produce as outputs, pointing to the main requirements to conduct successful TI operations. Based on a classic, long-standing intelligence source [*Krizan,* 1999], Table 8 provides an example situation.

Step 2: TI Collection and Processing

Traditional methods for producing "intelligence" range from manually sifting through publications and journals, networking, or attending tradeshows, organizing

Table 6. **TI Report Topics**

Item	Contents/Questions answered
Identification	Topic name, date, author contact
Bottom Line Up Front (BLUF)	Clear statement of the "Bottom Line Up Front" — the important overall message from this TI effort
Observations	What are the facts, data and key uncertainties about the observed external situation?
Documentation	Data sources; judgment on source reliability and information quality; where to learn more
Assumptions	What is assumed to fill in missing facts?
Interpretation	What do these observations mean for us?
Rationale	Why? What is the basis for the interpretation?
Recommendation	So, what? What should we do? Why?

Source: author.

Table 7. **Key Intelligence Topics**

Category	Items	Contents
Early-warning topics	Competitor initiatives, technological surprise, product demand shifts, market changes or governmental actions	• Tracking the development of emerging technologies using a systematic and consistent mining of information to provide a heads up for these technologies that can disrupt one's competitive position, • Early warning of new entrants or departures affecting the competitive space based on their position and investments in relevant new technologies • Alerts of new technology partnerships that will change the market landscape for one's products
Descriptions of the key players in the specific marketplace	Competitors, customers, suppliers, regulators, and potential partners	• Assessment of competitors' use of current and advanced process technologies and how that is affecting their production costs or output • Assessments of the business and technical health of technology providers • For Technology Scouting, what key players are using a new production control system that we should consider for our business?
Strategic decisions and actions	Development of strategic plans and strategies	• Evaluating candidates for long-term investment in new capabilities or a new partnership • Assessment of the long-term potential for emerging technologies • Detecting and interpreting the often weak, non-obvious signals from technology or market landscape scans

Source: author.

focus groups, hiring outsourced consultants, or just surfing the Internet or specialized databases. These methods, even in combination, are useful, but still have a number of drawbacks: it is difficult to identify relevant information, these methods take long periods of time to complete, they are resource-intensive, expensive, and ultimately return unpredictable, often incomplete or inadequate, results. However, by combining internet content, premium scientific and engineering journals, and patent information with "smart" search technology and analysis, a new breed of technology tools allows companies to quickly search and summarize answers that are not available through traditional search methods [*Das,* 2020]. The key difference here is in the approach and results: this is the first step in cutting information overload and finding solutions to technical and business problems through results that are relevant and have meaning [*Buzzanga,* 2008].

TI Sources

Like other forms of competitive and national security intelligence, TI collection uses a variety of sources from which to gather the range of relevant information. Data gathering also employs a variety of approaches, based on the type of source, the focus of the investigation, the role of time constraints and resources available. TI sources used for TI collection fall into four categories summarized in Table 9.

Table 10 shows the basic, broad characteristics of the main types of intelligence sources. The source types are also aligned with national security intelligence terms that are used to label them.

The sources for TI fall into three groups that permit useful comparisons between the use of sources for specific types of input data.

Primary sources can be found both internal to an organization as well as outside on markets or other venues and represent one of the most valuable ways to gather firsthand information. Table 11 lists several specific examples of human sources from which both current and past information can be obtained. Mechanisms for collecting primary information emphasize direct human conversation where interaction and discussion can occur, but, also today, telephone conversations and social media are widely used avenues for communication and therefore, primary collection. In addition, direct observation of intelligence targets, such as inspecting or reverse engineering equipment, is also a primary source collection mechanism.

Reverse engineering is the process by which a man-made object (e.g. equipment or software) is decon-

Table 8. **Basic Items of Successful TI Operations**

Item	Description / Answered questions
The Intelligence Problem	Company Y learns that Company X has suddenly reorganized their production department
The Intelligence Need	Company Y CEO wants to know why and how Company X changed
The Intelligence Requirements	• What changed in Company X's production department? • How large an effort was it — large, fundamental investment or modest equipment and raw material rearrangements? • How will the change impact Company X's production costs and their competitive position relative to us?

Source: author's elaboration based on [*Krizan,* 1999].

Table 9. **Summary of TI Sources**

Type of Source	Description
Primary	Sources that involve direct interaction with humans or direct observation of items of interest • Communication (interactions with one or more persons) — Distant contact (e.g. phone) or close contact (face-to-face) • Direct Observation — visits, tours, inspection of sites of interest, and "reverse engineering"
Secondary	Sources that provide processed, documented and published information in hard copy or electronic form
Technical	Sources that use equipment to gather and transmit characteristics of the items being measured (photographs, sample chemical emissions from a chemical process plant or other imagery)
Mixed	Documented primary information (reports/summaries). Discussion or meeting recordings

Source: author.

structed to reveal its designs, architecture, or to extract knowledge from the object; this is similar to scientific research.

Secondary Sources include both internal and external materials that are publicly distributed and/or available. In addition, secondary sources also include so called "gray literature", which is usually available publicly, but not produced for wide public distribution within commercial or academic distribution channels. Table 12 shows several types of secondary sources, which are also important for competitive or market intelligence.

The third category can be described as *Technical Sources*, which are typically useful for technical intelligence applications, although at times the information can also aid with competitive or market intelligence. They have some features that overlap with Primary and Secondary sources. As shown in Table 13, most of these sources either produce outputs using specialized equipment that produce engineering measurements or include computerized databases with information on research, engineering, or technology developments.

Tables 11–13 illustrate the vast potential for intelligence information collection from a wide variety of sources. This range provides opportunities for the use of multiple types of sources, or combinations of sources, to obtain unique data or aid with data validation.

Collection Processing

Usually, the raw collected information is not directly useful for analysis and intelligence production. Information collected from special-source human and technical collection must be processed into "intelligence information" that is usable by analysts and customers. Processing methods to improve the collected data include techniques to clean, organize, and clarify the data, and the addition of comments and interpretative notes that were not documented during collection. These methods will vary depending on the form of the collected information and its intended use (Table 14).

Step 3: Analysis and Synthesis

Once data are processed and reviewed, intelligence analysis is applied to give context to the data and enable the development of specific intelligence findings and recommendations for customers. The key activities will sometimes overlap with processing work. This includes hypothesizing causes for observations, making comparisons among different aspects of the issue at hand, forecasting events or trends, and assessing impli-

Table 10. **Basic Characteristics of the Main Types of Intelligence Sources**

TI Source	Description	Type of Information Available
People (human intelligence/ HUMINT)	Direct contact with human experts, eyewitnesses, participants	Firsthand knowledge, referral to other sources or expert opinion about things like technical feasibility, major delivery bottlenecks, etc.
Records (imagery intelligence/ IMINT or signals intelligence/ SIGINT)	Symbolic (written reports) or non-symbolic (images, data logs)	Research, background information, conversion to useful form such as an electronic or a standardized format
Objects (IMINT)	Physical characteristics of tangible objects such as equipment, products (size, shape, markings)	First-hand reporting on composition, condition, origin, design, functionality or human purpose
Emanations (Measurement and signature intelligence/ MASINT, OR signals intelligence/ SIGINT)	Detectable phenomena emitted by natural or man-made objects (heat, sound, chemical. Electronic or radiological residues)	Scientific and technical metrics of performance or features of the target

Source: [DoD, 2004]

Table 11. **Primary Sources**

Category	Items
Internal	• Technical Colleagues • Technical Networks • R&D Managers • Gatekeepers, creative staff • Library staff • Legal/IP Staff • Functional Staff (marketing, planning, etc.)
External	• Customers • Technical Colleagues • Technical Authors • Suppliers/Vendors • Trade Association Staff • Trade Shows, Conferences, Seminars • Consultants, Industry/Academic • Financial/Securities Analysts • Executive Recruiters • Journalists • Special Interest Groups • Journal, newsletter editors • University professors • Association/society staff • Expert Panels/Advisory groups • Retired employees

Source: author.

cations and potential actions for customers in light of the intelligence needs identified earlier in the process.

Analysis Concepts

Intelligence analysis is the process of reviewing, validating, selecting, synthesizing, and interpreting collected evidence to gain awareness of current situations, explain key activities, and forecast potentially important future developments of interest to stakeholders. The focus in analysis is on results and findings about what is going on and what is likely to happen next — addressing the basic questions of the 5 Ws plus One mentioned earlier. These questions frame and define the intelligence problem. Intelligence analysis is an iterative process that involves the application of individual and group cognitive methods and tools to weigh data, build hypotheses, and test them within a practical intelligence problem context [*Heuer,* 1999]. Analysis usually benefits from a group process since that approach forces the consideration of multiple explanations and interpretations.

One of the most important jobs of an intelligence analyst is determining the veracity of source data and information. Intelligence inputs, especially the people-based ones labelled HUMINT, can be fragmentary and of questionable reliability. Much of this information comes from speculation, second-hand rumors, or even can be just plain lies. The process of evaluating data for reliability, validity, and relevance, integrating it, and converting it into a useful processing and analysis inputs is an important element of building confidence in intelligence sources and results. Although intelligence analysis is not a branch of science, it bears some important similarities to scientific work. As in scientific studies, TI analysis involves:

- generating and testing hypotheses to explain source data,
- assessing levels of uncertainty in both the evidence and working conclusions,
- effectively communicating these findings to stakeholders, usually with some form of probabilistic or "level of confidence" statements.

Intelligence analysts focus on certain events, actions, persons, or sources to develop propositions or hypotheses that describe and explain what has been observed; and then use the hypothesis to make predictions about what is likely to subsequently occur. A critical evaluation of the data is done, usually by breaking down a subject into its constituent parts and describing the parts and their relationship to a whole picture. This is especially important for patent data since patents represent current technology positions that with further development can lead to potential future developments, sometimes long into the future [*Ashton, Sen,* 1988, 1989].[3] Patent positions are usually integrated with other technology to produce improved processes or new product developments. Analysis uses a mixture of methodologies to find a relationship between the pieces of information, then synthesize this information to draw inferences from the relationships. It is important for analysts to protect themselves against biases and mistaken assumptions that are built into "mental models" or "mind sets" that we all have to assimilate and evaluate our experience of the world

Table 12. **Secondary Sources**

Category	Items
Internal Literature	• Corporate documents • Previous TI reports • TI databases (literature, reports, etc.) • Trip and contact reports • Email • Chatroom documentation • Market assessments • R&D plans • Proposals • R&D/Technology Staff reports • Sales Force reports • Purchasing/Procurement documents • Regulatory/Legal documents • Manufacturing descriptions
External Distributed Literature	• Technical journals • Patents • Annual Reports • Reports, studies • News — press, newsletters • Conference Exhibits • Special information — employment ads
Internet	• Websites • Chat Rooms
External Grey Literature	• Company reports, brochures • Dissertations/theses • Trade or product literature • Government documents • Working papers • White papers

Source: author.

[3] See also: https://www.patsnap.com (accessed 14.02.2020).

Table 13. **Technical Sources**

Category	Items
Remote Sensing	• Remote Imagery and film • Still & Motion Photography • Chemical, Electromagnetic, Radiological or Chromatic Emissions
Technical Databases	• Technical Associations • University Programs • Government S&T Laboratories (National and State)
Reverse Engineering	• Equipment • Business Practices

Source: author.

[*Krizan,* 1999]. A systematic approach to analysis that explicitly considers a range of alternative explanations and outcomes offers one way to guard against dismissing potentially relevant hypotheses and supporting information — which can lead to missed opportunities to assess or warn. To complicate matters, there are few standard ways to perform such analysis, while a wide range of approaches and tools are available.

TI Analysis Techniques and Tools

Effective intelligence analysis incorporates elements of three families of techniques:

- *diagnostic techniques* that are primarily aimed at establishing the transparency of analytic arguments, assumptions, or intelligence gaps**;**
- *contrarian techniques* that explicitly challenge current thinking and approaches;
- *imaginative thinking* techniques like "brainstorming" that aim to develop new insights, different perspectives, and/or alternative outcomes.

A variety of computerized information analysis tools are used by TI practitioners to help organize, evaluate, and conduct various analysis processes on information for intelligence uses. One well-known source contains a systematic evaluation of several dozen such tools used in science, technology, and innovation (STI), other intelligence problems, and many other technology analysis applications [*Fleisher, Bensoussan,* 2002; *Fleisher,* 2006].

Several popular examples that focus on technology characteristics, companies, and innovative developments are listed in Table 15. Discussing these methods is beyond the scope of this paper, but many sources describing them are available. Experience demonstrates there is no single tool or technique that can fully address the range of common S&T analysis tasks. Analysts will also need to understand which combinations of tools and techniques can be most effective in meeting particular kinds of critical intelligence needs [*Herring,* 1999]. The application of a combination of tools over the course of producing the intelligence is usually required; understanding what sequence of techniques will be most effective is usually challenging.

Step 4: TI Production & Reporting

Technology intelligence is deliberately produced; it is not just passively collected. This means that the data and analysis outputs described are evaluated, integrated, and interpreted by skilled TI practitioners. As a practical matter, intelligence production refers to creating *finished* briefings or reports for decision makers or other customers. The emphasis in production is the synthesis of "all source" intelligence inputs to produce a comprehensive assessment of an intelligence problem situation. For example, in the private sector, input data may be produced from library or online research specialists, HUMINT staff who conduct interviews and attend conferences and trade shows, or for technology intelligence, engineers or scientists who perform work on products, design or product-related materials. These specialists would forward their reports to a centralized intelligence body that produces a synthesized finished intelligence product for the customer using all available inputs. One main aspect of intelligence production is the preparation of a "Bottom Line Up Front" (BLUF) statement as part of the deliverable — one that presents the overall conclusion in a clear, concise way that is easily understood by the customers. This is part of what intelligence professionals deliver as their response

Table 14. **Processing and Examples of Data Collation**

Data processing	• integrating, arranging, and annotating related information; • evaluating the accuracy and reliability of each item; • grouping items into logical categories; • critically examining the information source; • assessing the meaning and usefulness of the content for further analysis — including some effort to draw tentative conclusions about the relationship of «facts" to each other and their significance; • identifying information gaps to guide further data collection and analysis and providing a framework for selecting and organizing additional information.
Data collation examples	• filing documents; • statistical analysis; • network evaluation; • data analytics and visualization; • condensing information by categories or relationships; • using electronic database programs to store, sort, and arrange large quantities of information or data in planned or dynamically established patterns.

Source: own elaboration based on [*Krizan*, 1999].

Table 15. **Popular Analysis Techniques and Tools**

No	Method	No	Method
1	Analysis of Competing Hypotheses	10	Scenario Analysis
2	Linchpin Analysis	11	Scientometrics
3	Benchmarking	12	Shadowing
4	Disruptive Technology Assessments	13	Strategic Relationships
5	Driving Forces	14	SWOT
6	Event and Timeline Analysis	15	Technology Forecasting
7	Indications and Warnings	16	Technology Scenarios
8	Literature Mapping and Bibliometrics	17	Trend Analysis
9	Patent Analysis	18	Foresight Studies

Source: author.

Table 16. **Options for Packaging the TI Results**

Type	Items
In Person	• Personal sit-down meetings • Briefings • Seminars, retreats • Working groups
Distant contact / correspondence	• Email • Groupware • Internet posting • Newsletters • Trip reports • Contact memos
Documentation	• Reports • Action Plans • Videos • Still photography • Diagrams • Chemical emissions data

Source: author.

to the original intelligence problem and the specific intelligence needs that drove the process. Intelligence is rarely as complete as the customers would like. It usually consists of information fragments, analyst estimates, and judgments to support the main findings and key messages. However, these must be persuasive to justify the action recommendations, since following these will consume time and resources that the organization must supply. This production phase should include some "reality checking" to ensure that the messages and back-up materials make sense.

Step 5: Delivery & Feedback

Once the finished intelligence is developed and finalized, it must be delivered to the customers to "close the loop" and debrief the process. The main aspects of this step include messaging, customer feedback discussions, and follow-up support. It is important for TI products to use delivery mechanisms and formats that are appropriate for the overall messages and that address the original customer needs and dissemination preferences. Delivery approaches range from formal reports or presentations to electronic mail and one-on-one conversations, tailored to meet customer preferences. Several options for packaging the TI results are shown in Table 16.

Many TI professionals believe that a face-to-face presentation and discussion is the best approach for most delivery processes — with suitable backup documentation. This format enables customer feedback comments, which are crucial to assess the intelligence value, discuss follow-up actions and develop suggestions for improvement. Discussion with customers after products have been delivered will enable continuing intelligence to be provided as needed, integration with other inputs, and a check on cross-cutting issues or values that were not apparent early in the process. Many customers will want more than just the BLUF, so the intelligence team must be prepared to present the evidence and rationale for the findings and recommendations. This material should include a discussion of the quality of sources and source material, and judgements about "analytic confidence" — rating statements about what is known with high (and low) confidence — to convey doubt to customers, especially about estimative probabilities. This reflects the imperfect state of knowledge and limitations of the conceptual models used in the situation. Finally, the messages are more persuasive when coming from analysts that have high credibility and when being presented consistently from different sources — because messages can be ambiguous if they are interim, based on assumed scenarios, and still under development [*Lichtenthaler,* 2007; *Rohrbeck et al.,* 2006; *Önkal et al.,* 2013] and therefore seem inadequate to cover all the situations.

TI Project Example — An Unsuccessful Equipment Offering

To illustrate major elements of a TI project, a published example case study from Air Products & Chemicals, Inc. (APC) is summarized in this section [*Brenner,* 2009]. The discussion is presented in a structured, comprehensive format, with headings that incorporate and fit into the five main intelligence process steps of TI projects as presented in this paper. The discussion concludes with an explanation of the benefits of the project for APC.

Intelligence Problem: The TI group at APC was approached by a business unit to do an analysis of an APC equipment offering on the industrial gas supply market vs competitor offerings. Industrial gas technology involves equipment to gather, clean, pressurize, measure, store, and distribute industrial gas. The APC business group thought that the APC product development organization had come up with a superior offering, but the product was not selling well.

Table 17. **Factors Covered by the Example TI Study**

No	Item	No	Item
1	Cost	14	Geographical coverage
2	Performance	15	Customer loyalty
3	Differentiated technology	16	Marketing skills
4	Speed	17	Coordinated/integrated approach across company
5	Breadth of offering	18	Customer focus
6	Flexibility	19	Customer service
7	Economies of scale	20	Distribution
8	Innovative programs/services	21	Downtime
9	Availability of new products/services	22	Ability to deliver on time
10	Market position	23	Competition
11	Marketing mix, e.g., breadth/depth, complements	24	Technology changes
12	Quality reputation	25	Industry structural changes
13	Service reputation	26	Value added to products/ services, e.g., special warranties, extra customer care

Source: author.

Step 1: Customer TI Needs Assessment

Customer TI Assignment: The TI group was assigned to help determine whether APC should continue with the current offering or implement modifications, which would likely require a continuing product development project.

TI Requirement: The group was assigned to assess each competitor based on key factors that determine new product success on the industrial gas market and compare them to each other and APC.

TI Project Scope: The TI group began by scoping the project work — identifying competitors and market success factors. Company experience indicated that many factors contribute to the success of a new product offering on the target industrial gas market. The team developed an extensive list of relevant factors shown in Table 17.

This original factor list was narrowed to a manageable number by reviewing similar projects from the recent past. The discussions included an important debate between the TI and business groups at APC about the relative importance of these criteria when setting the priorities. This illustrates the point that substantive issues can arise during interaction between technical and marketing groups to potentially complicate TI project work. APC was able to work through these issues successfully.

Step 2: TI Collection and Processing

External Search strategy: An online, HUMINT, patent, and document search plan was developed to describe each competitor's position on each of the final factors. Based on initial broad searching and internal APC discussions, the TI group identified a final set of key factors for success in their target marketplace. This included knowledge and perspectives of both the APC commercial and technology groups for this product area. Different perspectives were raised during these discussions regarding whether this product was a technology or commercial "failure".

Search process results: The external searching brought objectivity and balance to the internal group biases. The search process expanded the team's knowledge about each competitor's position on each factor, including what APC competitors' thought were the keys to their success as well.

Step 3: TI Analysis and Synthesis

Analysis Preparation: To prepare for the equipment offering data analysis, the group completed a Background Package to integrate what was discovered and focus on the factors determined to be most important for market success. This involved the consideration of other internal information and included the flexibility to adjust the factor priorities during the review.

Analysis Process: To analyze the data on each competitor, the group planned a SWOT analysis to tabulate what we had found for each criterion and each competitor, including APC. The SWOT seemed like a good fit for the problem as it was likely to generate the strategies for change that would be needed (see Table 18). This method revealed gaps in the team's knowledge that were continually addressed throughout the analysis session.

Step 4: TI Production & Reporting

TI Findings: As the team discussed and came to an agreement upon the strengths, weaknesses, opportu-

Table 18. **SWOT Format Guiding Strategy Development**

	Internal Strengths	Internal Weaknesses
External Opportunities	S-O Conclusions and Strategies	W-O Conclusions and Strategies
External Threats	S-T Conclusions and Strategies	W-T Conclusions and Strategies

Source: [*Brenner*, 2009].

nities, and threats, the nature of the "failure" changed dramatically. Although the APC technology was considered to have differentiating characteristics, the customers interviewed found it to be roughly equivalent to the competitive offerings. Also, the analysis highlighted critical problems in the APC effort — that the APC business offering was late to the market, had missed the dominant customer, had far inferior marketing and visibility, and also, somewhat surprisingly, featured unclear roles within the APC business team due to overlapping or unassigned responsibilities.

Identify Candidate Follow-up Actions: The team then used the SWOT process to create four mini-scenarios that addressed how APC should deal with the situation. Then, using the scenarios, the team selected action strategies that worked for multiple scenarios. It was clear that the business had many significant actions to pursue.

Step 5: Delivery & Feedback

Recommendations and Results: The team's recommendations included short-term milestones for both product modifications and marketing process adjustments, which were required for keeping the offering worthwhile. The recommended actions were pursued, but the milestone objectives were not achieved and the product offering was eventually abandoned.

TI group concerns: An interesting issue arose during a review of the project. The TI group project was being funded by the business organization that now appeared to be responsible for the problems. However, since everyone arrived at these conclusions together and since the SWOT generated actionable changes, the business staff were pleased with the results because they had clear evidence with which to now deal with many business development issues that had previously been difficult to define and reconcile.

TI Benefits: Due to the TI analysis, APC avoided continuing a development program to improve the technology, which would not have significantly changed their market position, and thereby prevented inappropriate efforts to continue promoting the offering. The result was significant savings of potentially wasted time and new product costs.

Conclusions

This paper has presented an overview of the basic features and current practices for the development and use of technology intelligence as applied in many private and government organizations. TI includes wide area surveillance and scanning to monitor technology landscapes as well as focused TI collection to assess or track specific technologies, R&D efforts, companies, or industry groups. Strong growth of TI in professional literature over the past several years strongly suggests that TI has provided real business value to the organizations that employ it.

Most businesses are aware of the main technology and market developments in their direct markets and areas of interest. However, new and disruptive developments usually arise from outside their field of view — from an area which would not normally be a focus of their corporate radar. Moreover, new developments are often not just a single technology, but emerge from combinations of new capabilities, often from unforeseen directions. As described in this article, these situations call for some form of an organized TI process that can connect the dots and assess the impact that an emerging technology may have on existing business assets and prospects.

This overview points out the three important areas of TI focus: early warning of threats and opportunities to avoid surprises, assessments of current players on relevant markets and along supply chains, and long-range insights for support of strategic planning and strategy development. A well-supported TI program with trained staff can take advantage of either near- or long-term developments in these areas to help position organizations for healthy growth and operations well into the future. TI, however, must have organizational support to remain a viable activity — not only from senior managers, but from regular customers, information professionals, and analytical specialists. The quality of relations between the TI staff and these organizational groups is a key element of ensuring long-term TI success. This means that the TI staff must seek feedback from others in the organization, evaluate their own performance, and constructively respond to what they learn. Many CI and TI units have eventually been shut down as a cost saving measure if these practices are not maintained. The pace and direction of TI growth is difficult to assess and predict. What is clear is that future business leaders will continue to apply technology as a core element of their business strategy and operations, which makes TI an important continuing business practice. Organizations will always need accurate, focused, and timely technology information to take advantage of technology opportunities and prevent technology-based disruptions by competitors and new players. The payoff from effective TI is a much better chance of long-term business success in their chosen marketplaces.

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Contemporary Practices of Intelligence Support for Competitiveness

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Abstract

This paper focuses on the practices, assessment approaches, procedures, and applied aspects of competitive intelligence (CI). The study relies upon a survey of CI practitioners conducted in 2019 and a comparison of its results with a similar survey in 2006. It was found that companies spend the time devoted to this activity mainly on processes that go beyond collecting information, including planning, analysis, communications, and management. Most enterprises have official divisions and profile managers. The results are used to perform a variety of strategic and tactical tasks.

The main sources of information are the Internet, company employees, customers, and industry experts. Compared to 2006, a new key resource has emerged — social networks. Of the analytical methods, SWOT analysis and the study of competitors are most often used. Several channels of communication are used simultaneously to disseminate the received information, mainly email and presentations are used. Key performance criteria are customer satisfaction and the number of decisions made based on the information gathered.

A comparative analysis revealed that over the period separating the surveys of 2006 and 2019, the function of the CR has become more formalized. The share of companies with centralized divisions and CI managers has grown. Currently, this activity more often goes beyond the simple profiling and evaluation of competitors. Technology assessment, economic, and political analysis are more actively practiced.

Keywords:
competitive intelligence; strategic management; market insight; competitiveness; innovation; technology

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Introduction and Background

Global markets can be regarded as "a tempestuous sea of risks and opportunities for many companies" [*Stanat,* 2008, p. 6]. In such an environment, competitive intelligence is held to be vital not only to help markets grow, but essentially for their survival irrespective of the size of the company [Crayon, 2019]. In addition, the rapid transformations taking place in the global economy present several challenges for global competitive intelligence. The top five challenges as identified in the State of Competitive Intelligence Report [Crayon 2019, 2020] were:

- the difficulty in obtaining accurate and reliable data sources to stay "on top" of numerous sources of information and data available,
- timeliness of the data,
- the struggle to get internal buy-in from colleagues and the whole organization,
- the distribution of CI to all stakeholders and the sharing of competitive insights,
- the struggle to turn CI findings into actionable bottom-line drivers in the organization.

Hence, it is necessary for intelligence practitioners to keep track of the evolution and changes in the CI practices worldwide [*Du Toit,* 2015] to ensure that the organizations succeed.

To understand how CI is adapting to these forces, CI researchers, consultants, and associations will periodically survey CI practitioners and ask about how they practice CI. The purpose of surveys of intelligence practice are usually to provide the international intelligence community with an idea of the state of intelligence practice. It also provides an indication to both the academic and practitioner community about how to assess intelligence practice as part of CI. One such study examining CI practices from around the world was conducted 14 years ago in 2006 by SCIP (Strategic and Competitive Intelligence Professionals) and the Competitive Intelligence Foundation entitled "State of the Art: Competitive Intelligence" [*Fehringer et al.,* 2006]. The study was designed to identify how CI practitioners were working in the field at that time, differences in CI activities across industries and best practices that could be applied by companies.

In this study, we have attempted to replicate elements of the 2006 "State of the Art: Competitive Intelligence" study [*Fehringer et al.,* 2006]. While the 2006 study does provide a basis for understanding and gauging the trends as well as the changes and consistencies in CI practices globally, the instrument that was developed by CI practitioners and academics in SCIP was revised in the present study taking into consideration developments in the CI field since 2006. Further this study examines how it has evolved over time. This study looks at multiple aspects of intelligence practice such as competitive intelligence structure and organization, intelligence focus, information sources used, analytical techniques used, communication methods, and the management of the intelligence efforts. The survey provides an updated look at how CI practitioners are practicing CI, what CI is used for in organizations, and how it is evaluated. Like the 2006 study, this study also uses members of SCIP as a proxy for those that practice CI as the participants for the survey.

CI in Perspective

While there does not seem to be a single definition of CI that can be universally accepted [*Brody,* 2008; *Fleisher, Bensoussan,* 2007; *Bulger,* 2016, *McGonagle,* 2016; *Calof et al.,* 2018], meta-studies on competitive intelligence have found a high degree of consistency between different authors' definitions [*Du Toit,* 2015].

One of the early definitions of CI seen in the literature is that of Calof and Skinner: "Competitive intelligence can be defined as actionable recommendations arising from a systematic process involving planning, gathering, analyzing and disseminating information on the external environment for opportunities or developments that can affect a company's or a country's competitive situation… CI is a systematic program for gathering and analyzing information to find new opportunities and remain competitive." [*Calof, Skinner,* 1998, pp. 38–39].

A little over 15 years later, Du Toit [*Du Toit,* 2015, p. 15] examined 338 articles about CI looking at trends in the literature between 1994 and 2014. The author provided examples of the evolution of the definition of CI and included a definition based on a meta-analysis of CI definitions as "a process or practice that produces and disseminates actionable intelligence by planning, ethically and legally collecting, processing and analyzing information from and about the internal and external or competitive environment in order to help decision-makers in decision-making and to provide a competitive advantage to the enterprise."

This is similar to our earlier definition [*Calof, Skinner,* 1998]. While the definition of competitive intelligence has remained similar over the years, what has changed are the elements of how it is practiced. Bulger [*Bulger,* 2016, p. 57] writes "Continued globalization, vast amounts of accessible data on public platforms, and advances in technology are changing the complexity of competitive intelligence (CI) and presenting opportunities for experts with skills in this and associated fields and for organizations that utilize this expertise to create competitive advantage." Because of this change in the environment, Bulger advanced a concept called integrated intelligence which while not changing the definition, broadened the focus of intelligence and the skills required. Bulger states, "Originally, we looked at competitors. Now what we've done is actually integrated skill sets into the intelligence discipline. When I'm looking at an economic situation, I have a certain skill set that I need in order to understand economics and political situations in a

regulatory environment. When I'm looking at competitor intelligence and market intelligence, I need a skill set that really enables me to understand marketing, understand how to segment markets, understand how to build a competitive landscape, and understand competitors" [*Calof,* 2016].

For the purposes of our study and given the similarity in definitions, the authors adopted the Strategic and Competitive Intelligence Professionals definition of competitive intelligence taken from the SCIP FAQ at the time of the study:

> "CI is a necessary, ethical business discipline and/or skill-set for decision making based on understanding the competitive environment in order to drive competitive advantage in a marketplace. Any organization that has employees gathering information or developing insights on the external environment (competitors, external environment, customers, suppliers, technology, etc.) in order to make decisions is practicing some form of CI. CI validates decision making by introducing a disciplined system not only to gather information, but also to do analysis and disseminate findings about the external environment tailored with the intent to drive competitive advantage for their organization."[1]

As SCIP is the global association responsible for competitive intelligence accreditation it was felt that this definition was the most appropriate one to use. Embodied in this definition and the ones mentioned earlier are several dimensions:

1) A "disciplined system" with process dimension involving planning intelligence projects that will result in intelligence for decisions, the collection of information, analysis, communications, and management.
2) A "disciplined system" that has an organizational structure and personnel requirements. For example, an organizational dimension in what the SCIP definition mentions is having employees conducting these activities.

It is this broad view of CI that encompasses both process and organizational dimensions that we adopt in this paper in looking at global practices.

While we adopted this broad view of CI, there are others who view CI more as a primarily collection activity, this is a view that is seen in the marketing literature [*Tanev, Bailetti,* 2008]. On the ForLearn site of the European Union, foresight is defined as "a systematic, participatory, future-intelligence-gathering."[2] This definition explicitly states intelligence-gathering. The view that intelligence is about collection is so widespread that when Sharp [*Sharp,* 2000] wrote about "10 myths that cripple competitive intelligence" she focused a lot of attention in the article on differentiating between data ("data is material. It's numbers or facts"), information ("data in context"), and intelligence ("information that has been analyzed, and suggests actions, strategies or decisions"). Other studies have looked only at a few aspects of CI or how it could improve a specific aspect in the organization [*Nasri,* 2011], gathering, attitude, and use [*Bisson, Tang Tong,* 2018], and not the complete scope of CI.

In 2006, Fehringer et al. [*Fehringer et al.,* 2006] conducted a study on CI practices using the broad view of CI as espoused for this paper. Since then many studies have been done that use this conceptualization of CI as their base. Table 1 presents those studies that have used the more holistic, broader definition of competitive intelligence.

The studies in Table 1 use the broader view of competitive intelligence. All are country or regional studies. Thus, the authors seek to add to the competitive intelligence literature by conducting a state of CI study at a global level (not regional) and look at the CI activities of all firms (not just the large firms).

There have been many studies on CI practice published after 2016 (when the study survey design was completed) but these have also been regional/country studies. For example, there are reports on CI activities of European firms [*Calof et al.,* 2018] and Mexican firms [*Ojinga,* 2018]. There has also been many industry-focused studies on CI but there has not been an academic study on global CI since 2006. There however has been a host of "state of CI" reports done by consulting organizations. For example, Crayon consultants have made available to their clients and those registered for their reports annual "State of CI Competitive Intelligence" studies in 2018, 2019, and 2020.[3] Similarly, M-Brain consultants[4] have produced Global Market Intelligence Studies for over a decade, the latest was published in 2019 [M-Brain, 2019].[5] The surveys that both of these organizations (Crayon and M-Brain) conducted are similar to the one used in the studies listed above and ask questions about CI practices, structure, focus, communications, management, and so on — the comprehensive view of competitive intelligence mentioned earlier.

Similar to past CI studies, no hypotheses are advanced. The objectives are to help organizations understand how CI is being practiced. While the objective is not to compare the results from the study [*Fehringer et al.,* 2006], since 2006 there have been several global trends that are driving the need for competitive intelligence that could result in changes to CI practice [*Bulger,* 2016, p. 58; *Stanat,* 2008; M-Brain, 2015]. These include:

- The globalization of markets and the variation of the needs of each market.

[1] Available at: www.scip.org, accessed 19.03.2020.

[2] Available at: http://www.foresight-platform.eu/community/forlearn/what-is-foresight/, accessed 19.03.2020.

[3] Available at: www.crayon.com, accessed 19.03.2020.

[4] Formerly Global Intelligence Alliance

[5] Available at: m-brain.com, accessed 19.03.2020.

Table 1. **Example of CI practice Studies after Fehringer, 2006–2016**

Study	Geographic focus	Industry focus	Sample	Firms	CI Definition
[*Badr et al.,* 2006]	Europe	Pharmaceutical industry	79	All sizes	Technological foresight
[*Dishman, Calof* , 2008]	Canada	Technology	1025	All sizes	Competitive technical intelligence, Competitive analysis.
[*Du Toit, Sewdass,* 2014]	Morocco	All	25	All sizes	Economic intelligence, Social intelligence, Competitive technical intelligence
[*Sewdass, Du Toit,* (2014]	South Africa	All	24	All sizes	Competitive intelligence, Strategic intelligence
[*Sewdass, Du Toit,* 2015]	Brazil and South Africa	All	37	All sizes	Competitive intelligence, Strategic intelligence, Economic intelligence
[*Barnea,* 2016]	Israel	All	39	Large	Competitive intelligence, Military intelligence

Source: authors.

- The abundance of data — easily accessible and inexpensive with advanced technological developments.
- Shorter innovation cycle times — improving time to market, costs, and increasing competitiveness.
- Integrated approaches designed to comprehensively understand not only competitors, but also customers and the macro-environment and collaboration with other functional areas used to gain a comprehensive picture of a market.

It has been noted that in the global competitive environment, the relationships among people, markets, and business processes are becoming increasingly interlinked. Furthermore, globalization does not mean that all organizations standardize their local practices but instead they adapt global processes and practices to their local traditional environments [*Stanat,* 2008]. Hence these competitive companies practice CI within the bounds of their markets and local governmental policies as well as within global markets and standards.

Methodology

Survey instrument design

The development of a CI research instrument started with the one developed for the "State of the Art: Competitive Intelligence" study [*Fehringer et al.,* 2006] given that this instrument is recognized as a comprehensive one reflecting the breadth of the intelligence definition adopted for this paper and consistent with the professional association representing the field.

In the paper [*Fehringer et al.,* 2006], the authors presented the survey and the ensuing study as:

> "the first of its kind...comprehensive view of the current competitive intelligence field… To create the survey, we reviewed the questions asked in previous competitive intelligence surveys conducted by SCIP and by competitive intelligence consultants and vendors. We also solicited suggestions from the SCIP Meritorious and Fellows award recipients, and from individuals who are involved in the Foundation's Advisory councils." (p. 5–6)

Given the comprehensiveness of this survey and the methodology for its development, it formed the basis for our survey in this study and we followed a similar methodology to their study both in terms of survey design and execution.

Given the developments in the CI field mentioned in the CI in Perspective section (for example the broadening of the skills and focus under the integrated intelligence concept) and the global changes mentioned earlier, the authors of [*Fehringer et al.,* 2006] recognized that the questionnaire would have to have to be revised. The researchers reviewed the questions used in the studies noted in Table 1 (and others). The researchers also reviewed the competitive intelligence literature post-2006 for developments in the field that should be included in the survey. For example, the researchers looked over issues of the *Journal of Intelligence Studies in Business* and noted in several articles a lot of mentions of social media and analytics for competitive intelligence. These were not included in the 2006 survey but given their prominence in the current literature, we brought it into the new survey. Hence, a question pertaining to the use of social media sources for competitive intelligence and a question about which analytical techniques or models were used in organizations were added to the revised questionnaire. The questionnaire was also revised based upon discussions with industry practitioners, academics, and association personnel. One of the new questions that emerged from this group was on trade show intelligence. A topic that has grown in the CI field since 2006.

The revised questionnaire was then sent to five leading CI academics and practitioners for comment, additions, and validation. The revised survey was then pre-tested on SCIP members and revised again based on their feedback.

Sample framework and responses

The targeted population for this study were members of SCIP. This was a similar sample to that of [*Fehringer et al.,* 2006]. These are practicing CI professionals from various industries and countries. Similar to the 2006 study, SCIP agreed to administer the survey to their members. They promoted the survey in multiple newsletters, on their website, in emails to their chapter chairs, and at SCIP events including conferences and chapter meetings. In addition, SCIP chapter chairs were asked to send an email to those on their chapter contact list reminding them about the survey and asking them to complete it.

This resulted in 436 questionnaires being returned. Of these, 264 provided full details of their competitive intelligence practices while the rest provided overview information such as type of industry, size, geographic location, and a few details of their intelligence operations but not enough details for purposes of this article. Thus, it is these 264 respondents that we report upon. The actual response rate is difficult to calculate for two reasons:

1) Overall SCIP membership numbers are not provided by the association as this was felt to be confidential information, however they said that the number of respondents would represent more than 30% of membership,
2) While inclusion of the survey link in SCIP publications targeted only SCIP members, non-SCIP members do attend SCIP conferences and chapter events. In terms of the 264 surveys used, 63% were from SCIP members.

As mentioned in the CI in Perspective section, this study seeks to have a global focus and study firms of all sizes. This addresses a weakness identified in the literature. Of the respondents, 41% were from Europe, 43% from the United States, 4% from South America, and 12% from other regions. In terms of firm size, our objective was to have representation from more than just large firms and this was accomplished. Sixteen percent of respondents came from firms with under 100 employees, 22% from firms with less than 500 employees, 9% from firms with between 500 and 999 employees, and the rest from larger firms. These numbers mirror SCIP membership, but more importantly for the study, they provide a base of firms that are global and of diverse sizes.

Results

This section reports on the results of the survey. Given the similar methodology as was used by [*Fehringer et al.,* 2006] both in terms of the method for survey development, the use of SCIP members, and the help of SCIP in administering the questionnaire, comparisons are done for several of the questions in the findings section. While not statistically validated, it does provide an indication as to how CI practice has changed since 2006.

Table 2. **The Intelligence Process: the Percentage of Project Time Focused on CI Activities**

Type of activity	Percentage of time spent
Planning the intelligence project	13%
Collecting the information required for the CI project(s)	29%
Analysis (piecing together collected data and analyzing)	23%
Communicating the intelligence (formatting intelligence deliverables, writing the reports, etc.)	18%
Managing the project including meeting with the clients	10%
Evaluating the intelligence project	7%

Source: authors.

Creating intelligence vs collecting intelligence

As mentioned in the CI in Perspective and Methodology sections above, there are those who see intelligence as collection-based (you collect intelligence) and others who see it as a more comprehensive process (you create intelligence). Like past studies, as discussed above under CI in Perspective and in Table 1, we addressed the different views by asking respondents what percentage of their time was spent on collection activities versus other activities in their intelligence projects.

Is CI more than just collection? In our study, no survey response listed collection activities as taking 100% of the time spent on CI. The highest amount of time that any of the 264 respondents said they spent in collection activities as part of their CI process was between 61% and 80% and only 2% of the respondents were within this range. A total of 10% replied that between 41% and 60% of their CI time was spent on collection. On average, respondents indicated that 29% of their intelligence time focused on collection (Table 2) with 23% of intelligence time devoted to analyzing the information. The responses in Table 2 are consistent with the broader, more holistic view of intelligence that was adopted for this study.

The study [*Fehringer et al.,* 2006] did not ask respondents how much time was spent on each activity but

Table 3. **Structure of the Intelligence Function**

Type of structure	Percentage
Centralized: one CI function serves all or most of the organization	42%
Decentralized: each department or functional line of business does its own competitive intelligence	10%
Hub and spoke organization but centrally driven	1%
Informal: no structured CI function at any level, CI tasks occur only as needed and may or may not be labelled as "CI"	13%
Mixed: some activities are centralized, others are done independently by Individual departments or functional lines of business	34%

Source: authors.

Table 4. **Name of Department Responsible for Competitive Intelligence**

Name of unit	Percentage of respondents
Competitive intelligence	27%
Marketing intelligence	15%
Marketing/market research	12%
Strategic planning	11%
Multiple units	10%
Business intelligence	7%
Market insight	5%
Competitor insight	3%
Other names	10%

Source: authors.

asked them to rank the activities based on how much time was spent on them. The change in this study's survey arose as the experts/reviewers stated that putting in the percentage of time was more consistent with the recent literature. However, consistent with our results, in the study [*Fehringer et al.,* 2006], collection activities ranked first and analysis second in terms of the amount of time taken. All other elements of Table 2 had more than 10% of the respondents ranking them as taking significant CI project time.

Intelligence structure and processes

Respondents were provided with a list of five different types of structures for intelligence (including having no formal structure) and eight different titles for the unit (if it existed). Tables 3 and 4 present these results. The two most dominant CI structures were centralized units (one at the organization — 42%) followed by a mixed approach where there was a centralized unit and additional intelligence activities conducted throughout the organization (34%). A total of 13% replied that they did not have a formal unit. The number of those without a formal unit declined compared to the results in [*Fehringer et al.,* 2006] in which 20% did not have a unit, while a total of 34% had a centralized unit. This increase in formal CI was also noted in [*Calof et al.,* 2018] who reported in their study on European CI activities how CI had become more formalized over the past 10 years.

Regarding the name of the department responsible for CI — CI and market intelligence were number 1 and 2, respectively, but of note was the fact that 10% of respondents indicated multiple departments responsible for CI.

When asked how many full-time employees they had supporting CI, companies' most frequent response was 2-4 employees (37%), 33% having 1 or fewer, 167% had 5-9, and 15% had greater than 10.

Competitive intelligence procedures

The survey had several questions regarding the extent to which CI was formalized within the respondents' organizations: the formalization of a CI strategy, CI procedures, specific CI ethical guidelines, and a manager with CI responsibilities. Results are reported in Table 5.

In comparing the results with the study [*Fehringer et al.,* 2006], as mentioned earlier it appears that CI has become more entrenched and formalized. For example, 71.2% of this study's respondents had a manager with CI responsibilities compared 50.2% of the 2006 study.

The study also examined the extent of employee awareness of and involvement in CI. Only 1% reported that none of the organization employees knew that CI existed with 5% reporting that no employee participated in CI activities (Table 6). In comparing the results with the study [*Fehringer et al.,* 2006], 3.3% indicated that no employee participated in CI. These results are consistent with the broader and more holistic definitions of competitive intelligence that have more than just competitive intelligence unit employees involved in competitive intelligence activities.

Intelligence focus

Regarding the focus of intelligence, respondents were asked about the business decisions supported by CI and the type of intelligence products developed (for example market entry reports, benchmarking — Tables 7 and 8). Innovation-related intelligence topics were frequently mentioned including R&D decisions and new product development. These results are very similar to [*Fehringer et al.,* 2006] with the exception of technology-related intelligence which was rated higher in this study. In [*Fehringer et al.,* 2006] technological intelligence was ranked lower and had 24% responding that

Table 5. **Formality of Competitive Intelligence Efforts**

Formality level	% Responding)	
	Yes	No
Formal CI strategy	44.7	55.3
Formal CI procedures	42.3	57.7
CI ethical guidelines	56.5	43.5
Manager with CI responsibilities	71.2	28.8

Note: the total sum of responses in the columns exceeds 100% due to respondents being permitted to choose several response options.
Source: authors.

Table 6. **Company-Wide Knowledge and Involvement in CI**

	Organizations employees that	
	know CI exists	participate in CI activities
None	1%	5%
Few	18%	37%
Some	35%	42%
Most	26%	11%
All	10%	5%

Source: authors.

Table 7. **Frequency of Issuing Competitive Intelligence Products**

Format	Average	Percent responding frequently
Market industry/report/ analysis	2.4	54%
Benchmarking	2.2	39%
Company profiles	2.4	51%
Early warning alert	1.8	32%
Technology assessments	1.8	31%
Economic analysis	1.7	25%
Customer profiles	1.8	30%
Executive profiles	1.6	18%
Political analysis	1.4	15%
Supplier profiles	1.1	10%

Note: the responses were measured on a four-point scale (0 never to 3 frequently); the total sum of responses exceeds 100% due to respondents being able to choose several response options.
Source: authors.

it was frequently a focus in their CI program versus 31% in the present study. Further, economic analysis was frequently produced in 25% of the respondent's organizations and political analysis in 15% while in the study [*Fehringer et al.,* 2006] the combined economic and political analysis selection was noted as frequently produced by 17% of the respondents. Market industry was mentioned as a frequent product by 54% of the respondents in this study versus 32% in the [*Fehringer et al.,* 2006]. Therefore, it would appear that consistent with the integrated intelligence view, respondents' intelligence focus is broader now than it was in 2006.

A final aspect of focus examined in the study was the temporal orientation of the intelligence process, that is, how forward-looking the intelligence was. Respondents indicated that 50% of intelligence projects looked forward less than one year, 37% looked forward 1-5 years, and 13% looked forward more than 5 years (Table 9). This question was not part of the study [*Fehringer et al.,* 2006] and reflects the growing importance of technology-related topics that have a longer temporal orientation.

Table 8. **Business Decisions Supported by CI in the Organization**

Decision type	Average	% responding frequently
Sales or business development	2.3	49
Corporate or business strategy	2.3	47
Market entry decisions	2.1	39
Product development	2.1	39
Research or technology development	2.0	31
Mergers and acquisitions, due diligence, joint-venture assessment	1.8	27
Regulatory or legal	1.6	17
Reputation management/ communications/Public relations	1.5	19

Note: the responses were measured on a four-point scale (0 never to 3 frequently); the total sum of responses exceeds 100%, due to respondents being able to choose several response options.
Source: authors.

Table 9. **Temporal Orientation of CI Projects (how forward-looking intelligence projects are)**

Forward looking by how many years	Percent of time with this temporal orientation
< One year	50%
One to five years	37%
Six to ten years	9%
>10 years	4%

Source: authors.

Information sources used

Respondents indicated that the information collected for their intelligence efforts came from a broad range of sources. With the growth of the internet in terms of providing a broad range of both primary and secondary information, it was not surprising that this was the top source of information (3.3 in terms of its importance on a scale of zero to four and 54% in terms of it being noted as a very important source — Table 10). Other secondary sources such as publications and company databases were next in terms of importance in respondents' collection efforts (2.9 and 2.8). However, primary sources such as customers, employees, and industry experts were similar in importance to these other secondary sources (2.8 and 2.7). Given the responses in Table 6 with 95% of respondents stating that their employees are involved in their organizations' competitive intelligence efforts, it is not surprising that employees were amongst the more important sources of information noted in our study. The survey [*Fehringer et al.,* 2006] did not list social media but had a similar ranking as this study. In [*Fehringer et al.,* 2006], however, company employees were much more highly rated as a source.

Analytical methods or models used

Eighty-three percent responded that they used some kind of analytical model to develop intelligence with most using more than one model (on average, 5.4 techniques were used). Most frequently used were SWOT (Strength, weakness, opportunities, and threats analysis) and competitor analysis (83%), followed by benchmarking (69%), competitive positioning analysis (49%), and industry analysis (45%) — as illustrated in Table 11. The study [*Fehringer et al.,* 2006] also asked about the different techniques and the top two used in this study were also SWOT and competitor analysis.

Communication of intelligence findings

Email and presentations/staff briefings were the most frequently used methods for communicating intelligence findings (Table 12) with all respondents using multiple methods for communicating their findings. In comparing these results to the study [*Fehringer et al.,* 2006], it is not surprising that many of the non-electronic methods for communicating were more frequently used. For example, in the study [*Fehringer et al.,* 2006], printed alerts or reports were the second most frequently mentioned communication vehicles (45% frequently used versus 39% in this study) and, personal delivery was listed as frequently used by 37% of the respondents (versus 22% for this study). In comparison, the central database was listed as frequently used by 40% of the respondents in this study versus 32% in the study [*Fehringer et al.,* 2006] with email being virtually the same.

CI management/assessing CI effectiveness

The most frequently used method for assessing CI effectiveness was customer (the end user of the intelligence products) satisfaction followed by decisions made/supported (Table 13). Only 10% reported that they had no effectiveness measures. This result is in contrast with the study [*Fehringer et al.,* 2006] in which 30% of the respondents indicated that they did not have a CI effectiveness measure and 35% said they did not have a CI value measure. However, similar to the study [*Fehringer et al.,* 2006], customer satisfaction and decisions made/supported were the top two CI effectiveness measures. Similar to the findings in the CI structure section, 35% of the 2006 sample not having effectiveness measures versus 10% in this study does support the idea that CI has become more formalized at practicing organizations.

Table 10. **Sources of Information for CI**

Information source	Score (0-4)	Percent responding very important
1. Internet websites (free)	3.3	52%
2. Publications (print/ online)	3.0	39%
3. Commercial databases	2.9	38%
4. Customers	2.9	30%
5. Company employees	2.9	29%
6. Industry experts	2.8	28%
7. Internal databases	2.7	27%
8. Trade show/conference	2.4	18%
9. Social media	2.3	14%
- Blogs/wiki used for CI	2.2	18%
- LinkedIn used for CI	2.7	33%
- Twitter used for CI	2.0	19%
- Facebook used for CI	1.7	15%
10. Suppliers	2.0	10%
11. Government employees	1.5	8%
12. Association employees	1.5	4%

Note: the responses were measured on a five-point scale (0 not important at all to 4 very important); the total sum of responses exceeds 100% due to respondents being able to choose several response options.

Source: authors.

Table 11. **Respondents' Use of Analytical Methods and Models**

Technique used	Percent using the technique
1 SWOT Analysis	83%
2 Competitor Analysis	83%
3 Benchmarking (Best practices)	69%
4 Competitive Positioning Analysis	49%
5 Industry Analysis	45%
6 Financial Analysis and Valuation	41%
7 Customer Segmentation Analysis	40%
8 Scenario Analysis	40%
9 Patent Analysis	23%
10 Technology Forecasting	22%
11 Indications and Warning Analysis	21%

Note: the total sum of responses exceeds 100% due to respondents being able to choose several response options.

Source: authors.

Conclusion

The objective of this paper was to examine how intelligence is practiced and, in a sense, provide the *Foresight and STI Governance* community with insights in terms of:

1) How competitive intelligence practitioners define and operationalize the measurement of competitive intelligence
2) Report on how competitive intelligence activities are being practiced.

Table 12. **Communicating CI Results**

Communication channel	Average response	Percent responding frequently
E- mails	2.6	68%
Presentations/staff briefings	2.3	48%
Central database	1.9	40%
Printed alerts or reports	1.8	39%
Company intranet	1.8	38%
Newsletters	1.7	37%
Warning alerts	1.6	22%
Teleconference	1.6	21%
Personal delivery	1.5	22%

Note: the responses were measured by a four-point scale (0 never to 3 frequently); the total sum of responses exceeds 100% due to respondents being able to choose several response options.

Source: authors.

Table 13. **Assessing CI Effectiveness**

Metric for assessing CI effectiveness	Percent of respondents using the metric
Customer satisfaction	34%
Decisions made/supported	30%
CI productivity/output	24%
Strategies enhanced	22%
New or increased revenue	18%
New products or services developed	14%
Cost savings or avoidance	13%
We have no effectiveness measure	10%
Time savings	10%
Profit savings	10%
Financial goals met	10%
Return on investment	8%

Note: the total sum of responses exceeds 100% due to respondents being able to choose several response options.
Source: authors..

The study reported on the results from 264 respondents. The respondent companies were diverse in terms of size and geography. Using the Strategic and Competitive Intelligence Professionals (SCIP) membership as a basis for the study ensured that the survey would be sent to those associated with the practice of competitive intelligence. First, in terms of how the practitioners themselves define competitive intelligence, the study results supported a broader definition of competitive intelligence, beyond just collecting information. A total of 71% of competitive intelligence project time was taken up by non-collection activities including planning, analysis, communication, and management activities.

Organizationally, the study results also support the notion of a more formalized approach to competitive intelligence with 71% of the respondents having a manager with identified responsibility for competitive intelligence activities and 87% of all responding organizations having some form of formal CI structure. This kind of formal, company-wide effort was also reflected in the fact that in only 5% of the responding companies were employees of the company not involved with intelligence activities. In terms of intelligence focus, intelligence was used by the responding companies for many different types of strategic and tactical business decisions.

Regarding the collection side of intelligence, while the internet was clearly the number one source of information for company's intelligence efforts, a cluster of the second most important sources included primary sources such as company employees, customers, and industry experts. Respondents used on average 5.4 analytical techniques with SWOT and competitor analysis being the most frequently used.

Email and presentations were the most used approaches used for communicating intelligence with most respondents using multiple communications approaches. Finally, assessing intelligence effectiveness, an area of increasing importance in CI was noted as important in this study with only 10% of respondents to this question not having any effectiveness measures. The most frequently used measures were customer satisfaction and decisions made due to the intelligence.

Throughout the paper, the authors have compared various results of this study with a similar study conducted in 2006 [*Fehringer et al.,* 2006]. Readers are cautioned that the differences in some of the questions, their measurement, and the fact that no statistical measures were used in comparison limits the statistical validity of the conclusions. However, it does appear, based on a cursory examination of the two studies, that CI is more formal today than it was in 2006 with a higher percentage of respondents having centralized units and CI managers. Further, consistent with the shift in intelligence towards a broader mandate (integrated intelligence) the survey noted that compared to [*Fehringer et al.,* 2006], CI deliverables were more likely to involve more than just profiling and competitor assessments. For example, we noted increases in technology assessments, economic, and political analysis. This supports the notion of integrated intelligence [*Bulger,* 2016].

While this study has been successful in examining how competitive intelligence is practiced and identifying some changes in field since 2006 based on a cursory examination, a limitation of this study is that only members of SCIP (CI association) and those attending SCIP functions were used as a proxy for those that practice CI as the participants of the survey. In addition, only 264 responses received were complete and usable. It would be useful in future to conduct such a study with more CI practitioners and to include those that are not affiliated with SCIP. Future studies could also look at using analytics and statistical methods to test relationships and to measure CI practices at organizations. Finally, it would be useful to move towards causal models in studying competitive intelligence and cluster approaches as well that could help the field identify attributes associated with successful practice.

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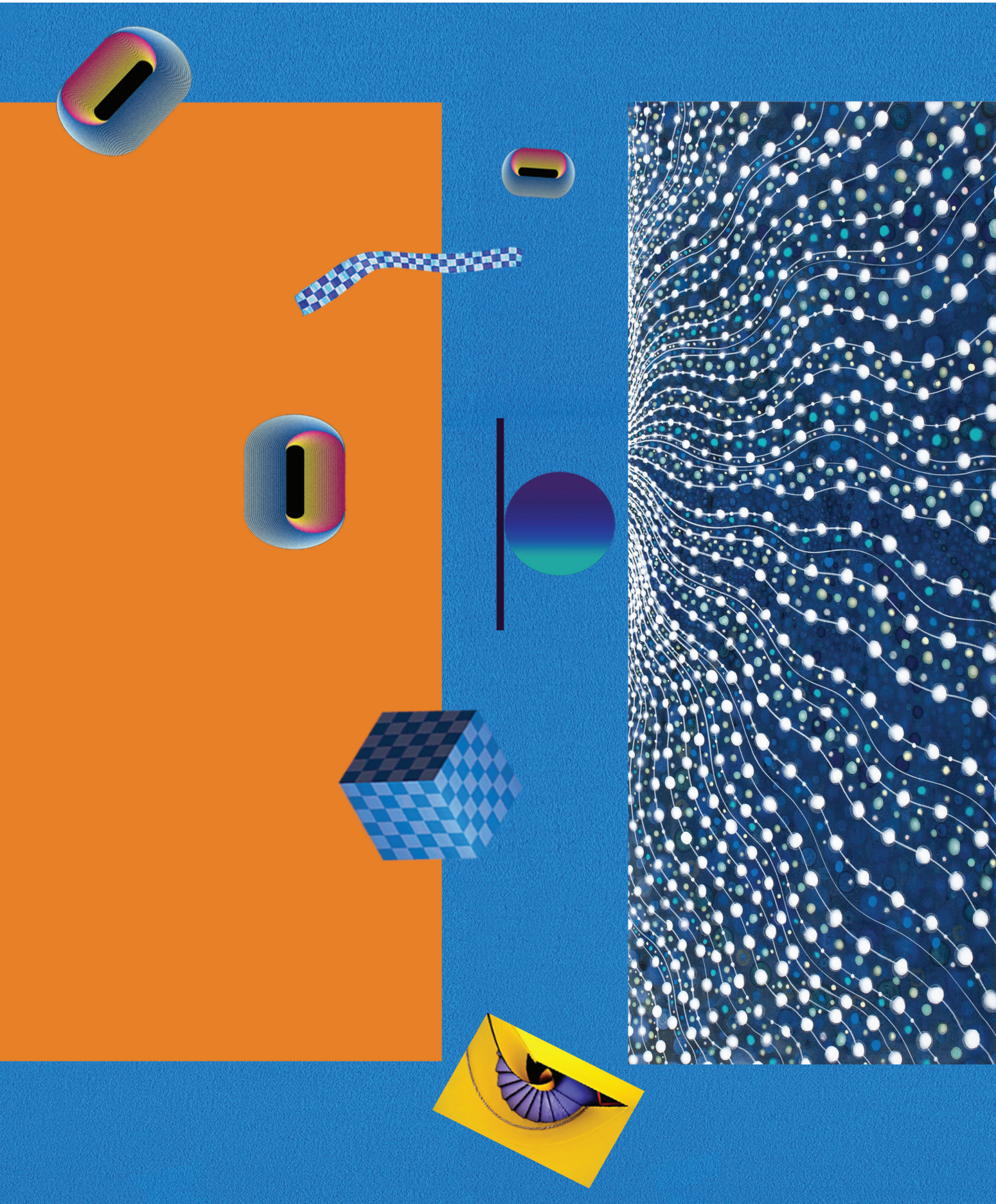
INNOVATION



Mapping the Technological Landscape to Accelerate Innovation

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Abstract

The quality of an innovative idea and the likelihood that it will lead to a successful new product or service is directly related to the quality of the information that is used to generate the idea and assess its value. Ideas based on a poor understanding of the underlying need or technologies that might be used to address that need will rarely succeed. An assessment of market attractiveness based on faulty estimates of customer readiness for your innovation and current or potential competitors' activities and their likely response to your offering is a high-risk effort. To successfully innovate, organizations need to have the best information possible to support their development efforts and up-to-date information on the eternal factors affecting an innovative project's success so they can decide whether it is worth continuing. Competitive Technical Intelligence (CTI) is a branch of Competitive Intelligence (CI) that provides those developing new technologies, products, and services the information required to make better project selection decisions by ensuring the organization has the best information possible on customer needs, technology options (including using external collaborations to speed development and manage risk), and the competitive environment. CTI continues to provide value throughout the development process by alerting project managers to changes that might affect the attractiveness of a project under development. While CTI shares many tools and approaches with other forms of CI, it has special characteristics that call for a different way of managing the intelligence collection and analysis. Specifically, it is common to supplement the CTI staff's capabilities in ways not often found in other types of CI by leveraging the interest, knowledge, and skills of their users, the technical staff. Drawing on over half a century of research on technology forecasting and innovation, and several decades of the author's working with organizations to establish CTI programs, this article outlines where and how CTI can help organizations enhance their innovative efforts.

Keywords: innovation; competitive intelligence; competitive technical intelligence; scenarios; technology forecasting; project management; stage gate

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Introduction

As companies look to become more innovative, they need to address two questions:

- are we working on the right thing?
- are we doing the work correctly?

Many approaches to innovation address the first question by finding ways to quickly collect and screen ideas. They then spend most of their energy on exploring how to develop the best ideas they found. They develop sophisticated project management systems that focus on getting the project completed in a timely manner and explore ways to accelerate the development or manage risk through alliances, incubators, skunk works, and other alternative development paths.

These are indeed critical questions to address, and much of my innovation-focused work with organizations involves adjusting the culture, reward systems, development processes, and so forth in order to address the special challenges of developing innovative offerings.

Why do many of these attempts at innovation fail? Many mistakes are made, but one of the most common and most harmful is that too little time is spent on addressing the first challenge: working on the right thing. Organizations do a beautiful job of developing a product or service that is not worth developing. They start the process at the wrong point, seeking ideas rather than seeking information.

According to the oft-distorted version of Lord Chesterfield's classic advice: *Whatever is not worth doing is not worth doing well.*

Innovation Starts with Information not Ideas

If you conduct an online search for graphics of the term 'innovation' almost all resulting pictures will show it starting with a light bulb, since 'everyone knows' that innovation starts with ideas. However, innovation does not start with ideas, it starts with information. Ideas do not just appear; they are generated based on the information the person generating the idea (the idea generator) has about the nature of the need and the alternative technologies that might be used to meet that need. Unfortunately, most models of innovation fail to recognize this and start the process with a search for ideas. Why is this?

Part of the problem can be traced to the tremendous success and value of Bob Cooper's work on project management, the stage-gate™ approach to effectively getting from an idea to the marketplace [*Cooper*, 2011]. There is no question that such a phased or gated approach has improved many organizations' ability to successfully get new products and services to market. Unfortunately, his model starts with that ubiquitous light bulb, sufficient for managing projects in the pipeline, but not where you want to start planning for innovation. This image of the development process starting with an idea is so firmly ingrained in our psyche that we are lured into starting the innovation process with a search for ideas, an approach that significantly limits our ability to innovate and ignores important research on how ideas and innovation work.

An idea is one way to create information by connecting two or more pieces of existing information. If the connection is one no one has made before, it is a creative idea. The existing information may have come from scientists who discovered new materials, engineers who developed new tools or market researchers who uncovered new customer needs or market trends. Ideas play an important part in information, especially creative ideas. Without a creative idea, a product or service concept cannot be truly innovative, that is the first offering of a product or service that is purchased and used. In the new product/service development context, the idea links a need (or pain point, challenge, customer request, 'job to be done', outcome, etc.) and a technology (applied knowledge to find answers or solutions). In short, the quality of an idea is a function of the quality of the information upon which the idea generator draws when making their connections.

Thus, if you want to be more innovative you do not start by collecting ideas, you start by collecting the information that is behind good innovative ideas: on current and emerging customer needs, on current and emerging technologies that might address those needs, and on the STEEP factors (Sociological, Technical, Economical, Environmental, and Political) that shape the competitive environment in which potential customers will be assessing the attractiveness of your offering.

This is not a new insight. Project Sappho was a study done in the UK in the 1950s that pointed out the critical importance of good customer need information on the success of the innovative efforts they examined [*Rothwell et al.,* 1974]. A study done at MIT in the 1960s by Meyers and Marquis to support the NASA Apollo program expanded upon this and added in the importance of technology information [*Meyers*, *Marquis,* 1969]. It found a very clear pattern for how successful innovative projects were developed (Figure 1). There are two key takeaways from this study:

- The innovation pipeline starts with information on needs and technology as the basis of innovative ideas
- Having stages or phases throughout the development effort provides an opportunity to reassess the value of continuing as you learn

The last point is critical in understanding the full importance of CTI on innovation. While CTI can help you generate ideas that have the greatest potential for success by starting with good information, its value does not end there. As noted in the MIT study, gates are important places to reflect on the wisdom of continuing a project as new information is learned, both about the project progress and the attractiveness of the opportunity. This insight was operationalized by Cooper's Stage-Gate™ process which many organizations now use. However, too often organizations use their gates to ask but one question: "are we on plan?" This is likely sufficient for routine projects where there are few unknowns other than whether the project is proceeding as planned.

However, innovative projects involve doing something no one has done before and by their nature have a lot of uncertainty both about the attractiveness of the opportunity and the soundness of your approach. As you proceed, those uncertainties are usually resolved, sometimes favorably ('the market is bigger than we thought') and sometimes less so ('the technology does not work'). The fundamental question that Cooper asks you to answer at each of the gate reviews is not: "are we on plan?" but rather: "should we continue?" Answering that question requires that at each gate you consider updated information on the factors that were considered when launching the project.

In short, organizations need to recognize the critical role of timely intelligence on the factors that will determine whether a proposed innovative effort is worth pursuing, both when it is launched and as it is being developed. To enhance the chance of innovative success, organizations should develop a structured approach to collecting and analyzing information that will not only stimulate better ideas but provide the means for a mid-course correction (or killing) of projects as the world around them changes. That is the domain of Competitive Technical Intelligence (CTI) — intelligence that provides decision makers with the information based upon which to select what technology to use, how to acquire it, and how to best use it to develop or enhance innovative products and services.

CTI Defined

CTI is an organized approach to:

- Anticipate competitor's intentions.
- Anticipate new technologies.
- Anticipate changes in drivers
- Provide inputs for project selection, execution, and review.

CTI ensures that technical decisions are based upon the best available information, consistent with legal, ethical, and resource constraints. It helps those responsible for the front end of innovation have the information to create meaningful innovative ideas linking current and emerging customer needs with current and emerging technologies that can be used to address those needs (Figure 2).

It also helps through the development phase of the project by providing information to help scope the project and address problems that are encountered during development (Figure 3).

CTI and Science and Technology Intelligence (STI)

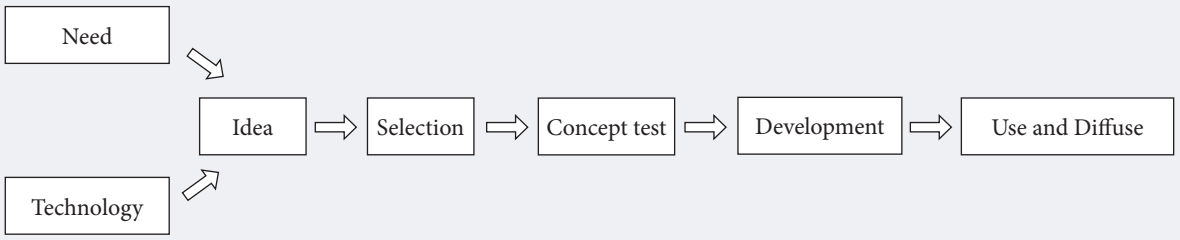
Science and Technology Intelligence (STI) is a major subset of CI that deals with developing intelligence *on* technology. It uses tools to assess patents, scientific literature, technical trade shows, and other sources of technical information to identify the who, where, why, and how fast new technologies are being developed or used. When editing a special issue of *Competitive Intelligence Review* [*Paap,* 1994] dealing with intelligence needed to support technical decisions, I wanted to differentiate the topic from STI and coined the phrase CTI. Much of the CI world divides itself into areas based on *what* is collected: financial intelligence, market intelligence, etc. CTI is not about the *what*, but *who* the intelligence is collected for, the technical manager tasked with identifying technologies that will allow them to develop the products and services that will meet their current and future customer's needs in a timely and competitive manner. CTI uses STI of course, but it also develops intelligence on customers, markets, competitors, and other external forces affecting decisions about what technologies might be needed to support an organization's innovative efforts. Since many practitioners now treat CTI as STI, intelligence *about* technology, the term Competitive Intelligence for Innovation (CI^2) is often used instead of CTI [*Paap,* 2018].

CTI is Project-Based

CTI is different than most traditional competitive intelligence (CI) efforts. The traditional approach to 'the CI cycle' was proposed by Jan Herring decades ago based on the approach used in the intelligence community (Figure 4). It is designed to support what Herring calls 'Key Intelligence Topics' (KITs) that are a subject of ongoing interest to the organization using the intelligence cycle outputs [*Herring,* 1999].

While some CTI activities fit this model, more often a one-time project-based approach is warranted. Rarely is there a need for ongoing collection and analysis of an area of interest. CTI follows more closely the principles of PMBOK — Project Management Book of Knowledge [PMI, 2017].

Figure 1. **A model of innovation from MIT NASA studies**



Source: adapted from [*Meyers, Marquis*, 1969].

While usually lacking the rigor of a PMBOK-based planning system, it shares the underlying logic of an activity with a specific start, finish, and internal reviews to refocus and or terminate. CTI is characterized by numerous 'one-off' intelligence efforts, such as:

- What is the impact of a new regulation upon customer needs?
- Who has a technology that can address this need?
- Is there a partner we should consider working with to accelerate development?
- Is this technology the right technology?

Having a project focus has several important implications for how the CTI effort is organized and managed. In traditional CI efforts where the focus is on a few KITs, the CI office typically is staffed with topic experts and much of their effort is focused upon building and using internal databases that they stock with relevant, up-to-date information on the companies, markets, or socioeconomic trends they are tasked with monitoring. It allows the CI staff to be able to quickly respond to intelligence requests, drawing on the information collected and stored on the target KITs. As needed, they supplement the existing information with additional collection and analysis of human source or external database derived information. CTI typically operates differently both in its use of databases and how it is staffed.

Database Implications

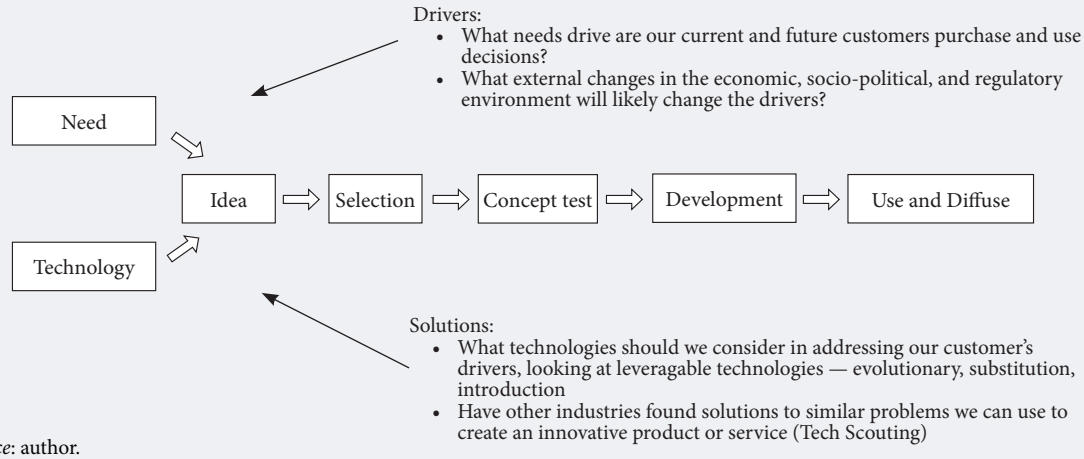
Over time CTI groups will develop intelligence that needs to be stored and retrieved and will usually have a database. However, unlike more traditional CI operations which continually update the KIT-focused intelligence inputs, the range of topics is too broad, and the frequency of looking at any individual area so spread out, that it is not practical to keep the database up-to-date. So, while the internal database can be used as a starting point for a project, there is more reliance on external sources (databases and patent mapping services) that are kept up-to-date by the service providers. Similarly, the use of supplemental intelligence collection through interviews, visits, or attendance at professional meetings plays a more significant role in CTI. Additionally, while traditional CI databases are often open to the organization at large as a resource when doing planning activities, access to CTI databases is usually limited to CI professionals who are aware that the intelligence may be out-of-date and should not be relied upon without updating.

Staffing Implications

CTI usually has too many possible areas of interest to justify having topic experts on staff. I was working with a major chemical and materials company helping set up new front-end planning and roadmapping processes. Separately they hired a consultant to design a CTI program for them. The chemical company had a diverse technical portfolio with a huge range of products ranging from commodities like fertilizer and basic chemicals, to more esoteric specialty chemicals and materials. The CI expert followed the script for staffing a CI organization with specialists in each of their major technical areas as well as specialists in online and human source collection. They recommended creating a CTI organization with over two dozen staff. This to support the development efforts of a 600-person R&D organization. It was a non-starter.

When they shared the report with me, I suggested they take a different approach. I had recently set up a CTI function at Shell's upstream research group that deviated from the established practice of creating an office full of subject matter experts. Shell's CTI office was very small (about half a dozen) and limited to those with expertise on data collection and analysis; technical topic expertise was drawn

Figure 2. **CTI and the front end of innovation**

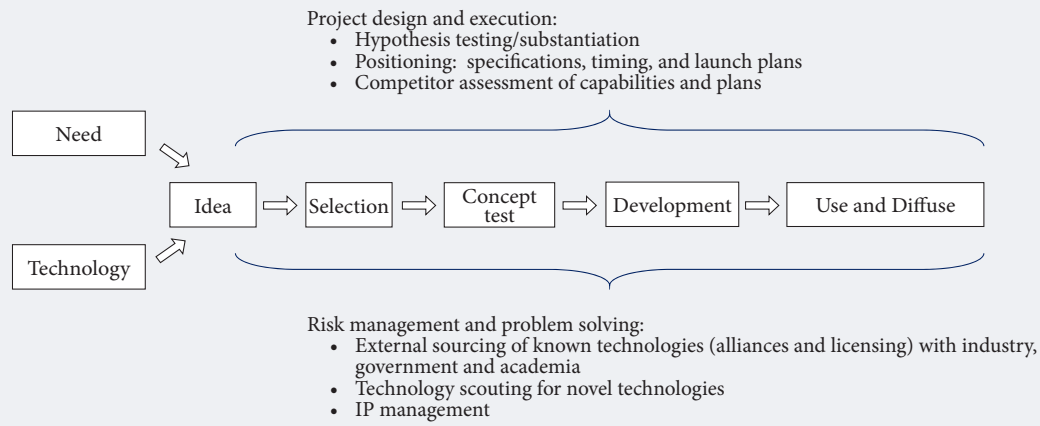


Source: author.

from the technical staff. When a project was begun, relevant technical staff were part of the planning. They helped identify the terms that might be used in online searches, the companies or universities that had expertise in an area and might be worth talking to, the professional associations that operated in their area, and similar information that could help focus the collection effort. Note: often internal technical experts have an inflated view of their level of expertise and when asked who they would suggest talking to, who was working on different technologies, their answer would often be: "no one, we have that covered." A better way to leverage your experts' insights into external activities is to ask who they knew of who is wasting their time working on an alternative (and inferior) technology to theirs.

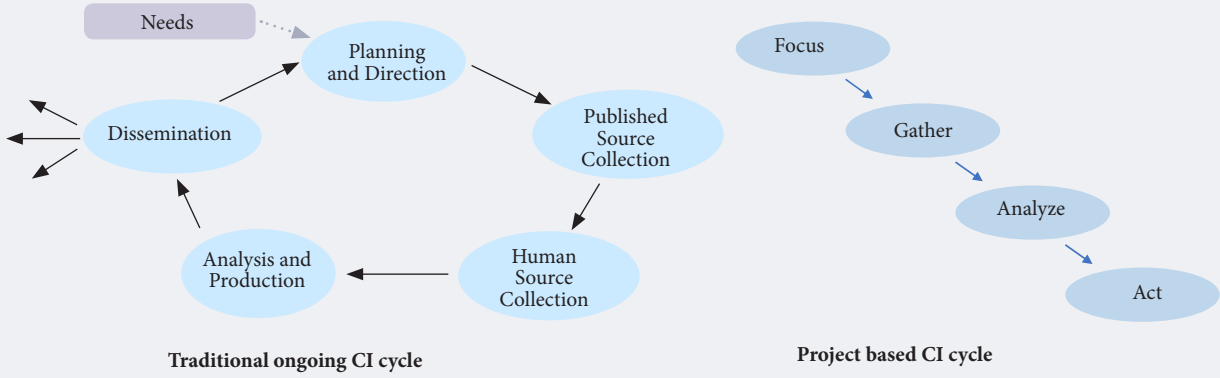
At Shell we also set up training programs for project managers, involving several hundred staff over the first two years. This was a new approach for them. Shell's scenario planning, Game Changer, and other futures thinking programs were (and are) amongst the best in the world. What we did here was to push some of this expertise down to those doing the project work. Project managers learned how to recognize when external intelligence could improve their project planning and thus become more frequent users of CTI. They learned how to frame a meaningful intelligence question to focus the search so that they were both more efficient themselves, but when they needed additional

Figure 3. **CTI and project execution**



Source: author.

Figure 4. **Alternative approaches to managing the CI effort**



Source: [*Herring,* 1999].

help, the CTI staff could respond more quickly. Project managers were given tools to do online searches more efficiently and trained in basic interviewing techniques to collect intelligence at professional meetings. Did they have the skills that a trained CI professional would have? Of course not. But they could now do many of the day-to-day collection and analysis tasks well enough that the CTI staff could focus on the more challenging intelligence questions. More importantly, the technical staff were already doing online searches, reading patents, talking to former professors, and interacting with colleagues at professional meetings. They could now do these tasks more effectively. The use of technical staff is an especially powerful way to collect CTI information at trade shows as they have the contacts and context to facilitate the efficient collection and assessment [*Paap,* 2007]. Additionally, the training raised the technical staff's awareness of the counterintelligence challenges of talking to others and thus made them less likely to share sensitive information with others outside of Shell.

What to Look for: NOMMAR ™

Exactly what types of information should CTI look for? There are many models outlining the information needed to generate and support innovative concepts. One I have found very powerful was developed during a multi-company roundtable I chaired in the mid-1990s. We called ourselves the Commercialization Roundtable and were made up of senior managers from nine major organizations responsible for promoting innovative new development efforts. The companies involved were AT&T, Digital Equipment, Dow, DuPont, GTE (now Verizon), IBM, MCC, Motorola, and Xerox. We met every month or two over 18 months to share our experiences in developing and commercializing innovative products and services. One of the areas looked at was the information needed to develop and validate an innovative concept. While each organization used slightly different terms, there was an underlying theme that emerged covering six factors that can be summarized as NOMMAR™:

- **N**eed — is there information that indicates there is or will be a significant unmet customer need?
- **O**ption — will a technology be available that could successfully address that need?
- **M**arket — is there a market for that approach, considering competitive offerings, its cost, and the operational or organizational changes that the innovative product or service might require the customer to make?
- **M**odel — is there a business model that convincingly outlines how it can be profitably developed, produced, and supported?
- **A**pproach — is there an approach available to our organization that is likely to allow us to successfully address the market?
- **R**elevance — if it can be done, should it; is it relevant to our overall strategy?

The first four questions combine information the company has internally with intelligence collected by its CTI team on activities outside the organization. Information on needs and technology options is used to stimulate ideas. Information on needs, options, the market readiness and size, and business models is used to assess the potential attractiveness of the opportunity.

The last two questions are answered primarily with information the company has internally to determine whether it is possible and relevant. However, CTI can often help with identifying a workable approach by identifying potential partners.

These questions are asked when first assessing a project, using the information CTI provides, and they are asked again at each gate using updated information provided by the CTI activity.

CTI Tools

It is beyond the scope of this article to go into depth on all of the tools that CTI uses. In the following section I will outline a few tools that I find most useful, focusing primarily on those used to answer the first two NOMMAR™ questions, as these are the ones most critical in helping generate meaningful innovative ideas.

Needs

The key to anticipating disruptive innovations is to anticipate changes in the needs that drive your customer's purchase and use decisions [*Paap, Katz,* 2004]. There are a host of tools that can be useful in identifying needs: traditional market research, consumer research, voice of the customer visits to current and potential customers, observation of your customer (popular with Design Thinking planning models (see e.g. [*Kelley,* 2016]), and emerging uses of social media and big data to find underlying patterns of behavior that help anticipate customer needs. For example, Amazon has patented and is using a system it calls 'predictive shipping' to use cumulative data collected on the habits of its customers to anticipate with a high degree of accuracy that a shopper will order a product in the near future so that they can move the product to a closer warehouse to the shopper's home ahead of the order and thus cut down on shipping time [*Natale,* 2019]. Most of these use interactions with customers to understand their current needs states or pain points and are effective in generating ideas for incremental improvements. They are less effective at anticipating future needs that exist but are not yet salient enough to affect your customers' behavior, or do not exist now but are likely to emerge as your customer's situation changes.

There are three tools that I find effective in anticipating future customer needs, needs that your current or future customers may or may not know they will have: technology forecasting, scenarios, and lead user assessment.

Technology Forecasting

I will cover technology forecast in more detail later as it is a primary tool used in the identification of alternative technologies that can be used to address customer needs. However, there is a role for tech forecasting in anticipating needs. Dick Davis was Manager of Technology Forecasting and Technology assessment at Whirlpool from 1968 to 1975. He was a student and colleague of Jim Bright, often recognized as the father of modern technology forecasting (e.g., [*Bright,* 1968, 1969; *Bright, Schoeman,* 1973]). Davis started one of the first professional CI practices at an industrial company, the Whirlpool Information Network (WIN) in the late 1960s and his futures-based CI work helped guide both the strategy and product development efforts at Whirlpool.

I worked with Dick after he retired from Whirlpool and learned much of my forecasting and CI skills from him. One of his favorite tools was technology forecasting. Not just on the technology that was needed to build their products. He did that of course, looking at control systems, power supplies, agitators, motors, and the like to ensure that Whirlpool was aware of the latest technology that might help them build better washing machines. However, one of his biggest successes at Whirlpool was using technology forecasting to anticipate needs their customers would have in the future based on changes in the technologies affecting their use of the washing machine, for example, water, detergent, fabric, and energy. He monitored technical developments in those areas and then assessed how these new technologies might change customer needs or priorities.

He learned of new developments in the fabric area where firms were working on wash and wear materials made of polyester and cotton blends that would reduce the need to iron (a major unmet need). Dick talked to the firms developing them and learned that changes in the wash cycle were needed for them to work well. Working with washing machine designers Whirlpool retooled their washing machines to work with the new fabrics well before the fabrics were introduced. Additionally, market studies had shown that one reason Whirlpool was not selling a dryer with every washer was that cotton bedsheets and garments from a dryer took longer to iron when a consumer used a dryer than if allowed to air dry. Reflecting on the implications of the new technology, he forecast that there would likely be an increased demand on dryers once bedsheets were made with the new blend that would emerge wrinkle free from a dryer with a cool down cycle. He convinced Whirlpool not only to add a cool down feature, but to expand its dryer capacity. As a result, once the new fabrics were introduced, Whirlpool was the only white goods manufacturer prepared to meet the new demands and Whirlpool's market share of washers increased significantly, and the sales of dryers exploded [*Davis,* 1973].

Scenarios

Tech forecasting is really a specialized version of scenarios. While scenarios have been around for decades, I have seen an increased interest in their use over the last five to 10 years. Scenarios are useful when your development cycle extends beyond the time frame that existing customer/consumer behavior models provide reliable information, and/or when technology is moving at increasingly rap-

id rates. As the world changes ever more quickly, companies are finding that even the near future is uncertain. When the future is uncertain, scenarios can help.

Many firms have a major misconception about scenarios, they believe that scenarios are tools to predict the future. Scenarios do not 'predict' the future; they identify multiple probable futures and provide a basis for understanding the implications of each of those possible futures on their business so they can prepare for it.

A recent scenario exercise outlines how useful they can be in helping to focus longer term development efforts, where longer term is defined not by the length of the effort but by when the development's impact will be felt. In 2018, a major energy company was looking to identify the early stage developments they would need to position their organization for future energy requirements 40–50 years out. Three scenarios sessions were held with about two dozen participants in each, with staff from research, sales, operations, and strategy. Prior to the session they were sent reports from various futures groups identifying mega trends and reports from market research and research trade groups identifying possible futures. At each session, the participants took turns identifying what they thought the world of 2050 would be like, drawing on their own experience, interaction with customers and colleagues, and reflecting upon the forecasts they were given. In each session common themes emerged that identified the core dimensions upon which the participants described the possible future. These were abstracted and possible positions on each were identified and the implications for customer needs and operations were identified.

The most likely combinations of the different dimensions were used to develop a picture of several future worlds that collectively represented most of the demands the company might be asked to meet. The next step was to identify what technical capabilities would be needed to address each of the future scenarios. As usually happens, a few technology families were identified as essential regardless of which possible future actually happened. This provided strong validation to begin planning for how the organization could develop or acquire those capabilities. Others were likely needed in only a couple of the futures. This led to two activities. First, competitive intelligence monitoring to get an early indication of whether one of those futures might occur. Second, the organization launched several initiatives to monitor and participate in developments in these less likely technologies using alliances, consortia, or university collaborations. The goal was to develop a starting point if and when it was determined they might be needed.

There are two historical examples that highlight how others have used this approach. IBM's work on the PC was a low-level affair for many years as they monitored the hobby computer market (TRS-80, Atari, Commodore, Sinclair, Apple, etc.). They did not believe that a business would ever need or buy a small computer, but their corporate goal was to offer any size computer a business might want. Once a business bought a small computer, they wanted to be ready to launch a comparable offering as soon as possible. When small businesses started buying VisiCalc for the Apple II, they moved the nascent development to Boca Raton, added staff, and launched the PC in record time. Much has been written about how IBM was able to develop the PC in record time due to a different structure (an internal venture), changes in project management approaches, and the like. All of these were critical in launching the PC. However, an important contributing factor was that they anticipated the possible (although they thought improbable) customer need for a small computer and prepared to move if required.

One last example is from Astra Zeneca's Project Orion [*Rosenkranz,* 2003]. Wayne Rosenkranz, who was a strategy and CI executive in their advanced development group, had a scenario session exactly as described in the first example. They used the results to justify the development of several new technologies that Astra Zeneca lacked in 2003 but would be needed if they hoped to be successful in twenty years, regardless of the future.

When we think of scenarios, we often think of looking out 20 to 40 years as in the examples cited above. However, the time is a function of the dynamics of your industry and the volatility and predictability of customer behavior and market conditions. A scenario session I participated in with a snack and cereal company looked three to four years out, well beyond the company's comfort level of knowing what to expect.

The Technology Paradox

The Technology Paradox is a challenge that organizations routinely face as the rate of change of the world around them continues to accelerate. It occurs when a technology they depend upon appears to be maturing and there is pressure to find and invest in the technology that will replace it. The challenge is that often the old technology has not reached its limits and pressure from competing technologies spurs innovative efforts to keep it alive and relevant. Consider the demise predicted in the mid-1980s for magnetic storage when optical storage first emerged. The threat from optical spurred innovation that kept magnetic storage

[3] The scenario exercises were part of a larger consulting assignment Dr. Paap undertook with the energy company as part of their long term planning effort..

alive for several more decades. A bigger challenge is that even if the old technology is in fact mature and due for replacement, there rarely is a single pretender to the throne, multiple technology alternatives emerge to replace the old technology.

This is the paradox: if we invest in all the new technologies while maintaining investment in the old technology (that might rebound) we will go broke. If we sit back and wait to see which one will emerge and begin development after it is obvious, we will be too late. Two practices can help manage the paradox. The one most often cited is the use of external collaborations as part of your development strategy. Corporate Venturing, as it was known from the early 1970s through the turn of the century [*Paap,* 1990], or Open Innovation as it is more often referred to today [*Chesbrough,* 2006], can help organizations address the technology paradox by enabling smaller bets on multiple alternative technologies through alliances, consortia, or internal ventures (as IBM did with the PC), and provide a return on the investment in developments they determine were not needed through spin-offs [*Paap,* 1991]. CTI is the second tool. It can provide an early read on possible futures and an early indication of which option is likely to win, and information on potential partners or spin-off buyers in support of collaborative development efforts.

Lead User

Lead user is an approach to uncovering customer needs and solutions based upon the existence in several industries of customers who develop solutions to needs they have that are not shared by a large enough segment of a company's target market to justify their working on them. Eric von Hippel at MIT has several decades of case studies of major innovations that were first developed by frustrated users whose developments came to the attention of larger firms who recognized that others also had or would have the need and they could adapt the lead user's approach. He cites the development of the first heart lung machine in the garage of a frustrated doctor who tired of losing patients because there was not enough time to do the surgery when the patient's heart was stopped, or the farmer in the Midwest who cobbled together pipe and wheels from his barn to make the first circular irrigation system to more efficiently irrigate his fields [*von Hippel,* 2011]. Figure 5 describes the underlying logic. First someone addresses a need they have that is too small for larger organizations to pay attention to. These are often picked up through social media, chat rooms, or websites in which similar potential innovation-inclined users are involved. If the need is widely felt, these other users adopt and often improve the solutions of the original lead user in what von Hippel calls user communities. Activity there is eventually noticed by larger firms (the Producers) who adapt the innovation for the larger markets they are interested in.

CTI can look for people addressing needs they have that are not yet broadly recognized by roaming chat rooms and looking through sites targeted at potential customers. Their target customers may eventually have the need, or always had and now recognize it, and the market could be large enough to interest larger product and service providers. By routinely visiting sites where users share their problems and solutions, they can often get a head start on a new innovative offering.

Some lead users keep the innovation to themselves. To uncover these, CTI teams can visit current customers to see how they have adapted or modified existing equipment or software. They may have a need you are unaware of, modified your product to address it, and there may be others who share that need. One way to view customers who use your product or service in ways that it was not designed for is that they are not misusing your product, they are telling you what they need. I recall engineers in the first consulting firm I worked in the early 1970s who broke into their Wang Word Processor and added code so that it could handle payroll and other personnel tasks. Wang never realized there was a need for a small computer, they made word processors. These had all the components of a minicomputer, just dedicated to the single task of word processing. Had they visited some of their more sophisticated users, they might have seen them modifying their machines and recognized these were customers who were letting them know about an unmet need they could easily address by modifying their equipment for others. Such an insight might have changed the fortunes of Wang.

Technology Options

While not its primary focus, CTI also looks for technologies. There are literally dozens of technology forecasting techniques. Probably the best inventory of tools I have found comes from John Vanston, another student of Jim Bright who describes the uses of more than 25 of them [*Vanston,* 2003]. I will look at three techniques not in the Vanston listing: Analogous Problem Exploration (APE), patent analysis, and crowd sourcing.

APE. The search for technology options is not just confined to forecasting the emergence of new technologies. Innovation does not necessarily involve either a new technology or a new need. What makes an idea creative is that it is a new connection. While it might be linking a new technology to a new or existing need, it might also tie an old technology to a new or old need. Too often the search for innovative technical information focuses on finding the newest 'disruptive' or 'breakthrough'

technology. Of course, organizations should learn about new technologies, but they also should learn about existing technologies used in other applications that might be newly applied to their needs. The goal is not to use the latest technology but to know about the latest technologies, other existing technologies, and then to use the right technology.

One tool that is useful in finding old technologies to consider when attempting to address your customer's need is a subset of technology scouting: Analogous Problem Exploration (APE). It is similar in logic to the TRIZ approach to creative problem solving [*Altshuller*, 1996]. Figure 6 shows the underlying logic.

The approach is quite straightforward. You take the need or problem you have, identify others that have a similar need, learn how they addressed that need, and consider using it yourself. There are two classic examples of this approach in James Burke's fascinating book on the origins of the building blocks for major innovations, Connections [Burke, 2007]. When the French were building the first internal combustion engines, they adapted the technology first used in perfume atomizers. The atomizer makers had developed expertise in the physics of combining air and liquids, and the machine tooling to create precision nozzles that would provide a uniform mixture. This is exactly what was needed to make carburetors. When Hollerith convinced the US government to use his idea of punch cards to process census data in the 1890s, he did not develop the card reader from scratch. He identified others who had a similar challenge and adapted bank's money counting machines as the first card sorters [Hollerith, 1894]. A visit to the US Mint in Washington DC will show that the size of the ubiquitous IBM punch card, which was the main way of feeding information into early mainframes and is still used by airlines and car rental firms, just happens to be the same size as US currency in 1890. He made his punch card the size of the currency so he could use the money counters.

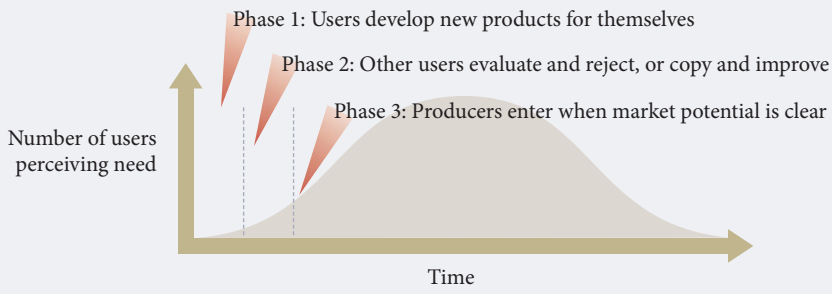
In a CTI project for an oil exploration firm a few years ago. we used this approach to find technology that could be used to help process noisy seismic soundings used to map oil reserves. Who else had technology to extract meaningful information from millions of pieces of noisy data? The answer was a company started by former NASA engineers who had worked on analyzing noisy data from space probes.

The key when looking for new technology is not to look for organizations that have a technology you know about, but to look for companies that share your problems and needs who may be using a technology you were unaware of or had never considered using in the way they are doing. Find organizations that face the challenges you face and learn from them. Too often technology scouting is used only after an idea has been generated as a tool to find someone who has a missing piece of your solution, scouting is a gap filling process. This is basically just a fancy form of procurement. CTI and scouting can have a much greater impact upon innovation by enlarging your awareness of the possible technologies that might be used to address a customer's need. It collects information before ideas are generated to increase the probability of having truly innovative ideas.

Patent analysis has been a basic tool of CTI for decades [*Ashton,* 1993; *Ashton, Klavans,* 1997]. It can help you identify who the players are, new developments in a particular technical area, and many sophisticated patent mapping programs can provide insights on development trends. Patent citation analysis can give insights into those patents that actually influence the developments in a particular field.

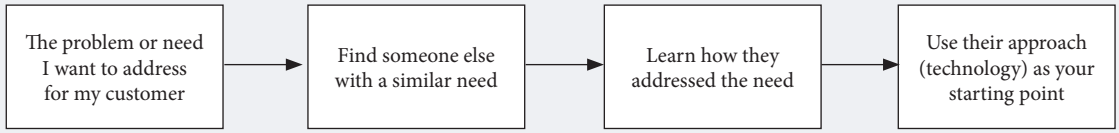
There are two areas where I find patent information can help innovation beyond their use in looking at

Figure 5. **The Lead user as a source of customer needs and innovative solutions**



Source: [*Von Hippel*, 2011].

Figure 6. **Analogous Problem Exploration (APE)**



Source: author.

new technology, development trends, and players. Patents can also focus human source intelligence by identifying the scientists and engineers who are at the forefront of their field. Patents tell you about what was done 'x' years ago. Those involved can often tell you what the current state of the art is. Reviewing their papers or talks or interviewing them can often give insights into what is coming next. Second, as patent mapping software has become more sophisticated it allows for a variation on the APE approach using patents. Increasingly patent search engines are using text mining to enable a search beyond predescribed data points and with the right algorithms it is possible to search for the types of problems a patent is addressing, not just a search on the keywords or technologies used.

Crowd sourcing is an oft-misunderstood term. Large numbers of people, crowds, generally have more noise than meaningful information. The key is to identify a subset of the crowd, a tribe or community, who have knowledge and insights worth tapping into and who you can trust with sharing your problem. Once you identify this community, you can solicit their ideas on how to develop solutions to needs that you or your customers have. Several public and internal platforms exist and when managed well can be a way of learning about new technologies.

On the surface, these platforms look like a traditional idea bank but there is something richer going on. As mentioned earlier, an idea is merely the combination of two or more pieces of information: a need with a technology to address that need. Figure 7 shows what is really going on when an idea is generated and submitted.

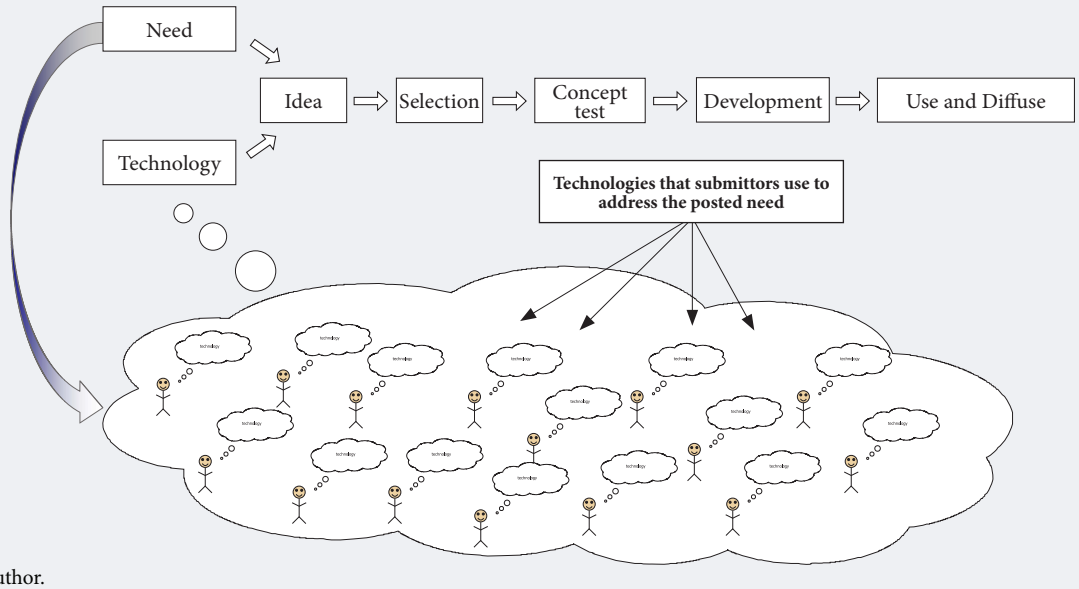
A participant in the community sees the need and draws on the technologies they know of that might be used to address it. They make a connection and an idea is generated which they submit. There are often hundreds of participants in the community so in effect you are tapping into hundreds of different repositories of technical knowledge. The implications for screening submissions are that the focus is as much on the technology the submitter used as the idea itself.

The experience of one government organization shows how effective this approach can be. Started in the early part of this decade, about a dozen government agencies who shared common goals created a platform to post challenges and request inputs from several thousand of their employees. Few submission requests were posted as originally written. Most challenges were attempts to find out how to implement the solution the submitter had come up with for meeting their underlying need, thus limiting the ways to address the need to variations of their approach. The request was re-written to indicate the underlying need and then a sponsor was found. One of the major insights about customer behavior is that not all of their needs are ones that if met will lead to your customer buying that solution [*Paap, Katz,* 2004]. They may have more important unmet needs they will work on satisfying first. It is basically Maslow's need hierarchy at work: you meet more important needs before you will spend time working on less important ones [*Maslow,* 1954]. A need's leverage refers to it being a need that a customer is sufficiently unhappy with that they are willing to do something to make it better. To ensure that all posted needs had leverage, a sponsor was identified who had both the interest and resources to implement the solution if one was found.

The submissions were examined not only for the solution itself, but also to explore whether the technology being suggested might be used differently to solve the problem better than was suggested. Often, two or more technological approaches from different submitters were combined. The focus was on learning about alternative technologies, not in screening ideas.

The results were impressive. At a 2015 meeting of representatives of the participating organizations it

Figure 7. **Using crowd sourcing to identify new technologies**



Source: author.

was reported that over 90% of the posted needs had been resolved and solutions implemented. The key was only posting high leverage needs and learning about technology options from among the member organizations.

The Rest of NOMMAR

To answer the remaining NOMMAR questions (Market, Model, Approach, and Relevance), CTI starts to look a lot like more traditional business and market CI. As a result, many CTI programs develop close relationships with the strategic and marketing CI groups to tap into their intelligence pools. The full range of intelligence collection tools are used to provide insights on the forces shaping the market and the attractiveness of your idea. CTI together with CI can help identify such things as:

- The size and readiness of a market.
- How competitors might react to your offering.
- What are others developing that might lure your target market from your offering?
- What business models have been used in similar ventures?
- Firms that might be available to partner as part of your approach.

Many of the traditional market assessment tools are limited in that they require that the customer being surveyed or questioned understands their needs (not always true) and appreciates the new offering (rarely true if it is truly innovative). So, the assessment often is done by finding analogues, other products, or services that had a similar genesis, and learning from them.

Conclusions

The reason Competitive Technical Intelligence (CTI) is so critical is based on the understanding that innovation starts with information, not ideas. Thus, organizations that desire to be more innovative need to spend significant time on efforts to gather and assess information as a prelude to idea screening and selection and continue to look for changes that might affect project success throughout the execution phase. CTI provides a structured approach to anticipate the future and acquire the information required to generate innovative ideas and effectively manage their development. CTI is usually managed differently than traditional CI using a project as opposed to ongoing process model, and heavily involves the customer in the focusing, collection, and assessing of the intelligence product. Drawing on a wide range of CI tools, both from science and technology (STI) and more traditional market and competitive intelligence, CTI provides timely intelligence to decision makers on the forces that will determine the eventual success of their development efforts.

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The Next Pharmaceutical Path: Determining Technology Evolution in Drug Delivery Products Fabricated with Additive Manufacturing

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Abstract

Additive manufacturing (AM) is increasingly gaining a presence in the pharmaceutical industry, specifically in the reconfiguration of drug delivery systems wherein new products are being developed for administering pharmaceuticals inside the body, and drug testing systems wherein complex tissues are created to analyze medical treatments. This paper proposes a novel methodology of Competitive Technology Intelligence (CTI) to uncover the evolution of new drug delivery products where additive manufacturing is present. Using the multiple linear regression analysis and hype cycle model as a conceptual basis, we processed data from scientific papers and patents indexed by Scopus and PatSnap for the period of 2004–2019. The outcomes of this study can create a relevant knowledge base for decision-making on introducing novel technologies such as AM. Industrial and academic communities are devoting important efforts toward the advancement of AM in the health industry, especially pharmaceuticals. It is expected that this technology will bring new solutions to address fundamental global health problems. However, this technology is still in its very early stage. Therefore, investments should focus on research and development (R&D) to build a solid foundation for commercialization in the next decade.

Keywords:
competitive technology intelligence; additive manufacturing; patent analysis; hype cycle; 3D printing; pharmacy; targeted drug delivery; new treatments

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Additive Manufacturing (AM), also known as 3D printing, rapid prototyping, and solid freeform fabrication, is a relatively new manufacturing method. Globally, AM and 3D printing are the most widely known terms. In 2015, the American Society for Testing and Materials (ASTM) defined AM as the "process of joining materials to make parts from 3D model data, usually layer upon layer, as opposed to subtractive manufacturing and formative manufacturing methodologies."[1] While 3D printing is defined by the ASTM as the "fabrication of objects through the deposition of a material using a print head, nozzle, or another printer technology" this term is often used in a non-technical context synonymously with AM. In order to solidify the materials, AM also uses a source of energy such as a laser, a binder, or an electron beam [*Ching-Chiang, Yi-Fan,* 2018]. According to the ASTM, AM is divided into seven principal categories: binder jetting, direct energy deposition, material extrusion, material jetting, powder bed fusion, sheet lamination, and vat photopolymerization. Each of these designations exhibit singular characteristics.

AM can contribute to the development and change of traditional pharmaceutical manufacturing due to its unique advantages such as the ability to create complex products, personalization, and on-demand manufacturing [*Liam et al.,* 2018]. Spritam (Aprecia Pharmaceuticals, Blue Ash, OH, USA) represents a pioneering example. Spritam is a drug that was produced using AM and was approved in August 2015 by the US Food and Drug Administration (FDA) [*Groll et al.,* 2018; *Jamroz et al.,* 2018].

According to a report by the U.S. Department of Health and Human Services and the U.S. Food and Drug Administration (FDA) in the next few years, we will see an evolution in medicine towards tailored medicine also known as precision medicine [*Hamburg,* 2013]. Personalized medicine is a field in healthcare that aims to personalize preventive and therapeutic strategies to the unique physiology, biochemistry, lifestyles, and genetics of individual patients [*Sadée, Dai,* 2005]. The evolution towards precision medicine is being driven by scientific and technological advances in complex fields from genomics to artificial intelligence as a consequence of the huge variability of people's reactions to drugs [*Evans, Relling,* 2004]. Demand for superior products related to drug delivery has been growing in the last few years and it is expected that personalized medication will bring enormous benefits transforming the health sector [*Jamroz et al.,* 2018].

While studies on the characteristics, applications, and processes of AM for the pharmaceutical industry exist, analyses to determine the dynamics of the scientific and technological output have been scarce particularly for drug delivery. In addition, due to the novelty of the field, the AM domain is constantly changing even in terms of its root conception. This study contributes to the advancement of research on AM for pharmaceutical applications, specifically filling the gap related to the lack of studies on the dynamics of scientific and technological production for Drug Delivery Systems (DDSs). To accomplish this goal, Competitive and Technology Intelligence (CTI) was utilized. CTI is a methodology that consists of gathering, analyzing, and transforming scientific and technological information to create relevant knowledge that contributes to the decision making of an organization [*Colakogly,* 2011; *Rodriguez et al.,* 2019]. Our CTI approach integrates 1) a hype cycle model to identify drug delivery products fabricated with AM and their development stage, and to broaden this scope, 2) a multiple linear regression was executed to determine the principal technology areas of medical inventions made by AM. Scientific and technological information was analyzed up to October 2019, when the collecting activity was concluded.

Background

Drug Delivery Systems

Drug Delivery Systems (DDSs) are focused on the controlled release of active pharmaceutical ingredients (APIs) in the human body. In order to develop DDSs, pharmaceutical engineering processes have been modified over the years pursuing both the highest performance to heal the patient and efficacy. Currently, the goal is to produce the most efficient administration of drugs. In this context, processes to enable drug transport into the circulatory system have been developed favoring drug movement across cells and tissues. Many new methods of drug administration have been formulated, varying from implantable devices using permeable membranes to injectable microspheres [*Rajgor et al.,* 2011; *Wang et al.,* 2017]. Also, DDS is carried out through nine different routes of drug administration: oral, topical, rectal, vaginal, parenteral, intradermal, inhaled, ophthalmic, and otic [*Liam et al.,* 2018].

AM has unique advantages for pharmaceutical applications, in fact, it is expected that this technology will revolutionize the development of new drugs and their delivery methods [*Jamroz et al.,* 2018, *Goole, Amighi,* 2016], specifically in terms of:

- *Personalized medicine:* AM provides the opportunity to customize the medication, by printing small batches of drugs [*Liam et al.,* 2018; *Goyanes et al.,* 2017; *Palo et al.,* 2017; *Trenfield et al.,* 2018] according to each patient characteristic: genetic profile, metabolic activity, and disease severity.
- *Drug release:* the flexibility to print medicine in a variety of doses and geometries, obtaining different dimensions, designs, and levels of porosities. Such are important characteristics that can alter the release of drugs in the body [*Goyanes et al.,* 2017; *Palo et al.,* 2017; *Sadia et al.,* 2016; *Trenfield et al.,* 2018].

- *Multiple Active Pharmaceutical Ingredients:* personalized products that contain multiple APIs according to specific patient requirements. An example of this product are the tablets known as polypills. The benefits of this combinatorial approach are significant, the primary being a reduction of the medical burden associated with a multitude of different medications for the elderly [*Liam et al.,* 2018; *Palo et al.,* 2017; *Trenfield et al.,* 2018].

Moreover, AM not only could facilitate the fabrication process by providing the possibility of carrying a specific drug dosage, but also allows controlling the speed of the drug release and its arrival to a specific location in the body,[2] being so attractive to improve efficiency for drug delivery purposes.

Hype Cycle Model

The hype cycle model enables researchers to understand the expectations for and maturity that a technology could have. It supports the R&D decision-making process considering costs and benefits connected with the adoption of a specific technology from its early stage to a superior stage of maturity [*Dedehayir, Steinet,* 2016; Gartner Research, 2018]. This model was created in 1995 for Gartner Group, a global research and advisory firm that provides information on how technologies may impact the organization and how to adapt to them and gain competitive advantages [Gartner Research, 2018; *O'Leary,* 2008]. The hype cycle model is represented in a bi-dimensional graph where the expectation or visibility measure of the technology is the "Y" axis and time is the "X" axis. This is divided into five phases: innovation trigger, peak of inflated expectations, trough of disillusionment, slope of enlightenment, and the plateau of productivity [*Dedehayir, Steinet,* 2016; Gartner Research, 2018; *Lente et al.,* 2013; *O'Leary,* 2008; *White, Samuel,* 2019] which are described as follows.

- *Innovation trigger phase:* this phase includes the beginning of new technologies, those with proof of concepts where the basic design research is conducted [*Dedehayir, Steinert,* 2016; *O'Leary,* 2008]. Also, venture investments take place with the hope of obtaining a highly competitive advantage by being the pioneers [*Dedehayir, Steinert,* 2016; Gartner Research, 2018; *White, Samuel,* 2019]. In this phase, initial media coverage could be high and generate significant publicity [*Dedehayir, Steinert,* 2016; Gartner Research, 2018; *White, Samuel,* 2019].
- *Peak of inflated expectation phase:* there is still limited information about the technology and how it can be applied [*O'Leary,* 2008]. The main characteristic of this phase is the optimism and exaggerated expectation that the media produces on the success stories [*Dedehayir, Steinert,* 2016; Gartner Research, 2018; *White, Samuel,* 2019]. Business investment and its participation lack a clear strategy and commercial viability [*Dedehayir, Steinert,* 2016; *White, Samuel,* 2019].
- *Trough of disillusionment phase:* this occurs when the technology fails in commercial adoption because the overinflated expectations are difficult to meet, so the company offering the technology needs to readjust expectations and meet performance goals [*Dedehayir, Steinert,* 2016; Gartner Research, 2018; O'Leary, 2008]. The interest of the media in this phase decreases due to the defective applications and commercial viability of the technology [*Dedehayir, Steinert,* 2016; *White, Samuel,* 2019].
- *Slope of enlightenment phase*: this takes place when the technology achieves more robustness and has grown both in its application and understanding [*Dedehayir, Steinert,* 2016; Gartner Research, 2018; O'Leary, 2008; White, Samuel, 2019].
- *Plateau of productivity phase:* this represents the beginning of the mainstream adoption of the technology [*Dedehayir, Steinert,* 2016; Gartner Research, 2018]. The technology expands its applicability and relevance on the market by presenting greater commercial viability [*Dedehayir, Steinert,* 2016; Gartner Research, 2018; *White, Samuel,* 2019]. Risk decreases and organizations feel more comfortable with the adoption of the technology [*O'Leary,* 2008].

In addition, the hype cycle model can show the different growth rates adopted by the technologies while undergoing the hype cycle, considering that each technology has unique characteristics that determine its evolution. In this respect, the hype cycle shows five periods: 1) less than two years, 2) two to five years, 3) five to ten years, 4) more than 10 years, and 5) obsolete before plateau [Gartner Research, 2018].

Multiple Linear Regression

The Multiple Linear Regression technique involves the observation of two or more points over time for the same case or individual. Of the different techniques that exist, multiple linear regression analysis was chosen as a complement to the hype cycle analysis as it facilitates the study of the relationship between two or more dependent variables and an independent variable over time.[3] For the purpose of this research, multiple linear regression was applied with the objective of determining the principal trends of patent activity through the analysis of International Patent Codes

[1] Available at: https://www.iso.org/obp/ui/#iso:std:iso-astm:52900:ed-1:v1:en, accessed 08.10.2019.

[2] Available at: https://www.nibib.nih.gov/science-education/science-topics/drug-delivery-systems, accessed 25.10.2019.

[3] Available at: https://data-flair.training/blogs/r-linear-regression-tutorial/, accessed 14.05.2020.

(IPCs), as they represent the technology domain that each patent has under a standardized and well-known classification. Multiple linear regression analysis provides the opportunity to identify the independent variable most significant for the dependent variable, by using the following equation:

$$Y_t = \beta_0 + \beta_1 x_{1t} + \beta_2 x_{2t} + \ldots + \beta_p x_{pt} + \varepsilon_{t'}(1) \qquad (1)$$

Where Y is the dependent variable and β_0 is the point at which the regression plane intercepts the *y*-axis. *x's* are the independent variables and β is its slope, the unknown regression coefficient. While *t* represents the time of observation and ε is the residual error of each observation.[4] In this study (Y) was examined as the total number of patents published by year with the specific IPC B33Y80/00 since it corresponds to the category of Products Made for Additive Manufacturing while the independent variables (x's) focused on the predominant 99 IPCs from the patent dataset previously determined. In a further stage, the IPCs that belong to the Medical Science category were studied as independent variables.

Methodology

First Stage. Determination of the Search Strategy

In order to collect the right scientific and technological information, it is important to create a proper search query with elements that define the domain of study properly. This research was driven by scientific documents and patents gathering, in which it was observed that the terminology related to AM is highly complex and is evolving constantly. As a consequence, a first identification of the International Patent Code (IPC) and of the most suitable terminology (keywords) was made.

IPC consists of an international hierarchical system applied in the patent record. This study considered the IPC B33Y80/00 that refers to "Products Made by Additive Manufacturing". With regard to the terminology, specific keywords were established through a deep analysis combining primary and secondary information sources: expert opinions and scientific publications from the Scopus database. In particular, consultations with AM and 3D printing specialists for pharmaceutical applications from The University of Nottingham were undertaken. For this study, two groups of keywords were built, one for AM and one for DDSs, Table 1 shows the obtained results.

Second Stage. Scientific and Technological Document Gathering

This involves information collection to generate different datasets. Scientific papers and patents were analyzed during this study. The first ones were used because they are documents that show the progress of research and are indexed by prestigious platforms such as Scopus. Meanwhile patents were considered as they reflect the advances of technological inventions backed by a government entity that grants rights and exclusivity.

This study considered both Scopus[5] and PatSnap[6] as reliable sources to show the progress of research and development. Scopus was used to retrieve scientific literature. This platform covers more than 20,000 scientific journals, 370 books, and 5.5 million conference proceedings. It contains a variety of information including citations since 1996 and library document summaries. Moreover, Scopus provides strong tools to analyze and graph worldwide research.[7]

To gather patents, the platform PatSnap was utilized because it is a powerful tool that has access to a database of more than 130 million patents across 128 jurisdictions.[8]

For both kinds of documents (papers and patents) the strategy search comprised the entire database coverage of Scopus and PatSnap until October 31, 2019, which corresponds with the end date of the collection period. For this study, three datasets were created as it can be seen in Table 2:

- The first dataset was built for the hype cycle analysis and it is comprised of scientific papers from Scopus describing drug delivery products made by AM. Keywords from Table 1 were used to generate the search query and collect documents.
- The second dataset was made for hype cycle analysis as well, but the type of documents is different, in this case, it included patents from the PatSnap platform presenting drug delivery products made by AM. For this task, the search query encompasses the IPC B33Y80/00 (Products Made by Additive Manufacturing) and keywords from Table 1.
- The third dataset was created for the multiple linear regression analysis in order to collect all patents related to products created by means of additive manufacturing, toward this end the PatSnap platform was utilized with a search query focused

[4] Available at: https://www.sciencedirect.com/topics/medicine-and-dentistry/multiple-linear-regression-analysis, accessed 14.05.2020.

[5] Available at: https://www.elsevier.com/es- mx/solutions/scopus, accessed 12.11.2019.

[6] Available at: https://www.patsnap.com, accessed 22.11.2019.

[7] Available at: https://service.elsevier.com/app/answers/detail/a_id/15534/c/10543/supporthu b/scopus/, accessed 22.11.2019.

[8] Available at: https://help.patsnap.com/hc/en-us/articles/360000299757-Search-And-Boolean-101, accessed 22.11.2019.

Table 1. **Terminology for Additive Manufacturing and Drug Delivery Systems**

Group		Keywords
AM		3D printing, additive manufacturing, freeform fabrication, desktop fabrication, solid freeform fabrication, binder jetting, material extrusion, direct energy deposition, material jetting, powder bed fusion, sheet lamination, vat photopolymerization, fused deposition modeling, fused filament fabrication, pressure-assisted microsyringe, semisolid extrusion, semi-solid extrusion, extrusion freeform fabrication, extrusion base* freeform, pneumatic extrusion, mechanical extrusion, screw extrusion, syringe extrusion, drop on demand, drop on drop, drop on solid, drop on powder, selective laser sintering, selective laser melting, stereolithography, digital light processing, 2 photon polymerization, continuous liquid interface production, continuous inkjet printing.
DDSs	Oral	Oral drug administration, oral dosage, oral dosage form, oral screening form, oral release controlled, oral drug release, oral drug delivery, tablet, caplet, pill, polypill, oral film, orodispersible film.
	Vaginal and rectal	Vaginal or rectal drug administration, vaginal or rectal dosage, vaginal or rectal dosage form, vaginal or rectal screening form, vaginal or rectal release controlled, vaginal or rectal drug release, vaginal or rectal drug delivery, suppository, vaginal suppository, DIU, IUD, intrauterine device, intrauterine contraceptive device.
	Topical	Topical drug administration, topical dosage, topical dosage form, topical screening form, topical release controlled, topical drug release, topical drug delivery, facemask, wound dressing.
	Intradermal	Intradermal drug administration, intradermal dosage, intradermal dosage form, intradermal screening form, intradermal release controlled, intradermal drug release, intradermal drug delivery, microneedle.

Source: authors.

on the specific IPC B33Y80/00 (Products Made by Additive Manufacturing). Further in a later section, the IPCs that comprise the Medical Science category were analyzed as the fourth stage exhibits.

In addition for the first two datasets, after the collecting activity, a data cleaning process was executed to identify incorrect or incomplete data, data not aligned with the study core, or papers that by themselves do not represent specific research as paper reviews. The third dataset did not require this process since the search was driven by the specifically the IPC B33Y80/00 (Products Made by Additive manufacturing) code, which belongs precisely to the domain under analysis for this study.

Since organizations frequently protect a patent in several patent offices, to avoid patent duplication the information obtained for the second and third datasets was filtered by a *simple patent family* (SPF), meaning that only the first patent application was examined. Knowledge of the case study and expert feedback were relevant in order to collect proper information for all the datasets. Table 2 shows the results obtained for each dataset.

Third Stage. Hype Cycle Analysis

The third stage starts with the identification of the specific components where the hype cycle will be applied, in this case, the different routes of drug administration for products fabricated with AM. As in the previous stages, the knowledge of the subject, revision of documents gathered, and advice from experts, particularly from The University of Nottingham, added a great amount of value. In total, five routes of drug delivery were identified where AM was applied, which include oral, vaginal, rectal, topical, and intradermal. Specific products belonging to each group were then determined. Table 3 shows the main outcomes.

After that, this stage continues with the identification of the bibliometric indicators and the evaluation criteria that determine each phase of the hype cycle. The hype cycle model has five phases listed above: Innovation trigger, Peak of inflated expectation, Trough of disillusionment, Slope of enlightenment, and Plateau of productivity. The cycle demonstrates that technologies evolve at different paces. In order to uncover the specific stage of technological development, this research established an additional division (stages) for all the hype cycle phases except the last one where technology is consolidated (applications are at a superior level and the commercial viability is already demonstrated). For this aim, the principles of Gartner [Gartner Research, 2018], the research of O'Leary, entitled "Gartner's hype cycle and information system research issue" [*O'Leary,* 2008] were considered.

Table 2. **Main Characteristics of the Created Datasets**

Dataset	Source of Information	Search query based upon	Number of documents obtained	Type of documents	Analysis to be applied
1	Scopus	Keywords	253	Scientific papers	Hype cycle
2	PatSnap	IPC and Keywords	81	Simple Patent Families	
3		IPC	5847		Multiple linear regression

Source: authors.

Table 3. **Identification of Drug Delivery Products Fabricated with Additive Manufacturing**

Dataset	Route of administration	Dosage form	Number of documents
1. Scientific Papers	Oral	Tablet	129
		Capsules	15
		Oral film	23
	Vaginal and rectal	T intrauterine device	5
		Suppository molds	2
		Vaginal ring	1
	Topical	Wound dressing	31
		Facemask	5
	Intradermal	Microneedle	42
2. Simple Patent Family	Oral	Tablet	41
		Capsules	13
		Oral film	0
	Vaginal and rectal	T intrauterine device	1
		Suppository molds	0
		Vaginal ring	2
	Topical	Wound dressing	9
		Facemask	0
	Intradermal	Microneedle	15

Source: authors.

After determining all stages, the bibliometric indicators and their evaluation criteria were established. Citations of the papers retrieved from Scopus were considered due to the fact that mass media sources that emerged since the citations represent the dissemination of the ideas expressed by the authors in other scientific papers. The "market attractiveness", "market coverage", and "technology quality" patent scores from PatSnap software were used as indicators of technological performance and market appeal. This platform evaluates these indicators on a scale of 0 to 100, where the "market attractiveness" score assesses the relevance of a patent on the market. The "market coverage" factor evaluates the market presence of a patent. While the "technology quality" indicator shows the degree of innovation according to the significance of the patented feature to the product.[9] Hype cycle phase determination and its evaluation criteria are exhibited in Table 4.

Once this phase description has been completed, it is important to apply both indicators: number of citations per year for each scientific paper and the "market attractiveness", "market coverage", and "technology quality" scores for each family patent. In this study, citations were determined using Scopus tools in the first dataset and, for patent scores, the PatSnap software was applied in the second dataset.

Fourth Stage. Multiple Linear Regression Analysis

This stage comprises the evaluation of the third dataset through multiple linear regression analysis of IPCs with the purpose of determining the technology trends in patents. This is where the identification of the principal technology areas of patents can lead to the visualization of trends that impact future product development, namely the products made by additive manufacturing.

For this task, specific IPCs as well as dependent and independent variables should be established. In particular, this analysis focused on collecting patents indexed with the IPC B33Y80/00 Products Made by Additive Manufacturing code whose publication year ranged from 2004 to October 31, 2019 (when collecting activity was concluded). As a result, information about 8,603 patents was obtained. After applying a SPF filter, the dataset was reduced to 5,847 SPFs, which registered more than 1,000 types of IPCs in addition to the IPC B33Y80/00 Products Made by Additive Manufacturing, since each patent can be indexed in databases with more than one IPC. For the purpose of this study, the top 99 IPCs (those most predominant in the SPF) from the more than 1,000 types of IPCs registered were considered for multiple linear regression analysis. The dependent variable (Y) was the total number of patents published by year with the IPC B33Y80/00, while the independent variables (X's) centered on the top 99 IPCs (Table 5)

The execution of the previous equation was performed in the software R and the results showed that only 10 IPCs were found to be significant for the dependent variable. Six of these IPCs had a positive impact upon the equation, which were: B33Y10/00 Processes of additive manufacturing; B33Y70/00 Materials specially adapted for additive manufacturing; B33Y30/00 Apparatus for additive manufacturing, details thereof or accessories therefor; B33Y50/02 Controlling or regulating additive manufacturing processes; B33Y40/00 Auxiliary operations or equipment, e.g. for material handling; and G06T17/00 3D Modelling for computer graphics (see Box 1).

However, the obtained results showed that there were no IPCs directly related to DDSs fabricated with AM because this is a relatively new field and patents are not public until after two years of being filed. This behavior can also be observed in the hype cycle analysis, where the number of patents indicating presence of additive manufacturing in drug delivery products is small, as can be seen in results for the second dataset shown in Table 3.

In order to complement the hype cycle analysis, a second multiple linear regression analysis was performed having as a dependent variable (Y): the total number of patents published by year with the IPC B33Y80/00 code, and as independent variables (X's): the IPCs

[9] Available at: https://help.patsnap.com/hc/en-us/articles/360000299757-Search-And-Boolean-101, accessed 22.11.2019.

from the top 99 IPCs previously obtained but only selecting those that belong to the Medical Science category. Due to the novelty of drug delivery products made with additive manufacturing, there is not a specific classification for them so far. Products related to pharmaceutical and drug delivery are included in the Medical Science category.[10] Results conveyed that only 28 IPCs of the top 99 IPCs belong to the Medical Science category. The six most predominant in SPF are: A61L27/56 Porous or cellular materials, A61L27/50 Materials characterized by their function or physical properties, A61L27/54 Biologically active materials, e.g. therapeutic substances, A61F2/28 Artificial substitutes or replacements for parts of the bone, A61C13/00 Dental prostheses, A61L27/18 Materials obtained otherwise than by reactions only involving carbon-to-carbon (Table 6). Interestingly, as the industry related to medical science is growing so fast, this study's outcomes indicated that the IPC A61L27/56 Porous or cellular materials and IPC A61L27/54 Biologically active materials, e.g. therapeutic substances contributed positively and significantly to the IPC B33Y80/00 Products Made by Additive Manufacturing (see Box 2). These two IPCs were identified as the drivers of the patent technological trends related to products fabricated with AM in the global category of medical science.

Results and Discussion

During the development of this study, the following insights were obtained. Firstly, it was observed that the terminology related to AM is highly complex and evolving constantly. As a consequence, the keywords used for the design of the information search strategy was so extensive, in some cases, it was difficult to classify, whereas terms associated with pharmaceutical

Table 4. **Hype Cycle Phases and its Evaluation Criteria**

Hype Cycle Phase	Bibliometric Indicator	Evaluation criteria	Stage	Stage Description
Innovation Trigger	Not enough information to evaluate with bibliometric indicators.	N/A	1	Beginning of the technology, proof of concepts where foundations to begin research are established.
	Number of Scientific Papers	Number of papers published > zero	2	Venture investment takes place. Attention from the media is frequently high and generates significant publicity.
Peak of Inflated Expectations	Number of Citations	An increase in the number of citations	3	Media usually produces exaggerated optimism and expectations to get success stories.
	Score Value of Patents	29 ≥ Average (Technology quality score and Market coverage score) ≥ 0	4	Detailed information on the technology and how it can be applied is scarce. Usually, a clear strategy is missing and commercial viability is not clear.
Trough of Disillusionment	Number of Citations	A decrease in the number of citations	5	Media publicity decreases due to failures and other technical issues including commercial viability.
	Number of Scientific Papers	A decrease in the number of papers published	6	Technological commercial adoption may fail since there were overinflated expectations that were difficult to meet. Technology needs to set new expectations to establish real performance.
Slope of Enlightenment	Score value of Patents	59 ≥ Average (Technology quality score and Market coverage score) ≥ 30 29 ≥ Average (Market attractiveness score) ≥ 0	7	Technology is solid with growing applications and better understanding.
	Score value of Patents	100 ≥ Average (Technology quality score and Market coverage score) ≥ 60 59 ≥ Average (Market attractiveness score) ≥ 30	8	The benefits of the technology are clear and have grounded objectives. The commercial appeal of the technology increases.
Plateau of Productivity	Score value of Patents	100 ≥ Average (Technology quality score and Market coverage) ≥ 60 100 ≥ Average (Market attractiveness score) ≥ 60	9	The technology expands its applicability and relevance on the market thus gaining greater commercial viability.

Source: authors.

[10] The category comprises a vast range of IPCs that are related to diagnostic-surgery, dentistry, veterinary instruments, prosthesis, transport for patients, physical therapy apparatus, device or methods for bringing pharmaceutical products, containers specially adapted for medical or pharmaceutical purposes, devices for administering food or medicines orally, materials for bandages/dressing, methods or apparatus for sterilizing materials, and devices for introducing media into or onto the body.

Table 5. **Independent Variables**

Independent variables	IPC	Number of SPF
X1	B33Y10/00	3272
X2	B33Y70/00	1328
X3	B22F3/105	982
X4	B29C67/00	855
X5	B33Y30/00	812
X6	B33Y50/02	552
X7	B33Y50/00	427
X8	B33Y40/00	320
X9	B28B1/00	238
X10	B23K26/342	230
X11	B29C64/106	230
X12	B22F5/00	219
X13	B29C64/386	218
X14	B29C64/118	214
X15	B29C64/153	213
X16	B29C64/112	182
X17	B22F3/24	170
X18	B22F3/16	156
X19	A61L27/56	155
X20	B29C33/38	152
X21	B29C64/165	145
X22	B29C64/10	144
X23	B22F5/10	143
X24	B29C64/393	141
X25	A61L27/50	140
X26	B29L31/00	140
X27	A61L27/54	121
X28	B22F1/00	117
X29	B23K15/00	109
X30	B29C64/40	109
X31	A61F2/28	108
X32	B22F3/00	107
X33	G06F17/50	103
X34	A61C13/00	102
X35	A61L27/18	102
X36	B22F5/04	102
X37	A61F2/30	101
X38	A61B34/10	99
X39	B29K105/00	96
X40	B29C64/00	93
X41	B22C9/10	92
X42	A61L27/58	85
X43	F01D5/18	85
X44	B29C64/20	83
X45	B22F7/08	82
X46	B29C64/124	78
X47	G05B19/409	78
X48	A61L27/38	75
X49	B22F7/06	75
X50	B22F3/11	74
X51	A61C8/00	70
X52	B22F3/10	68
X53	B23K26/00	67
X54	B29C64/209	66
X55	B29D11/00	62
X56	F01D5/28	62
X57	A61L27/12	61
X58	B22C9/02	58
X59	A61B17/17	57
X60	C04B35/622	57
X61	A61C7/00	56
X62	B23K26/70	56
X63	B29C64/30	56
X64	B28B1/30	55
X65	B29C64/135	54
X66	F01D5/14	54
X67	B22C9/04	51
X68	B29C64/379	50
X69	A61F2/44	49
X70	G06T17/00	48
X71	A61L27/20	47
X72	A61L27/36	46
X73	F01D9/04	45
X74	A61L27/04	43
X75	B29C35/08	43
X76	A61L27/52	42
X77	B22C7/02	42
X78	A61B5/00	41
X79	B29C45/26	41
X80	A61B17/00	40
X81	A61C9/00	40
X82	A61L27/22	40
X83	A61N5/10	40
X84	B23K101/00	40
X85	B29C64/129	40
X86	G09B23/30	40
X87	A61C7/08	39
X88	A61F5/01	38
X89	A61L31/14	38
X90	B22F7/00	38
X91	B23K26/34	38
X92	C12M3/00	38
X93	C22C14/00	38
X94	A61B90/00	37
X95	B22F3/15	37
X96	B29C64/141	37
X97	C09D11/101	37
X98	F01D25/00	37
X99	F01D25/12	37

Source: authors.

applications of DDSs presented a more precise definition. Secondly, in this research, drug delivery products fabricated with additive manufacturing and their evolution were identified through the hype cycle analysis of scientific documents and patents. Finally, multiple linear regression analysis was applied to identify the patent trends, however it was found that due to the early stage of this technology, there was not a specific classification for them. Instead, the Medical Science category where AM is used was applied for the identification of IPCs. This was carried out to broaden the scope of the study.

Drug Delivery Products Created with Additive Manufacturing

The presence of additive manufacturing to produce drug delivery products was disclosed according to the Hype Cycle Gartner model. For this purpose, the evaluation criteria presented in Table 4 were considered. Then, the evolution of drug delivery products was determined, Table 7 illustrates the obtained outcomes.

These results were transformed into a hype cycle graph considering the time range of the development for each type of product as Figure 1 shows.

The results of this research show that DDS is carried out through nine different routes of administration: oral, topical, rectal, vaginal, parenteral, intradermal, inhaled, ophthalmic, and otic. However, for only five of them: oral, topical, rectal, vaginal, and intradermal was evidence found of AM applications to fabricate them. Applying the methodology proposed in this study on these five groups, the following findings were obtained:

- Oral film, suppository, and facemasks are in stage 3 of the Peak of Inflated Expectations phase, where the media usually confer an overblown optimism to the technology. The results show a small number of scientific papers: 23 documents for oral film, two for suppositories, and five for facemasks. However, these papers presented a high number of citations: 495 citations for oral film papers, five citations for suppositories, and 90 citations for facemasks. Patent registration was not detected.
- Tablet, capsule, vaginal ring, wound dressing, and microneedles are products that have reached stage 4, which belong to the Peak of Inflated Expectations phase. During this stage, detailed infor-

Box 1. **First Multiple Linear Regression Analysis**

Y (dependent variable) = the total number of patents published by year with the IPC B33Y80/00

X's (independent variables) = the top 99 IPCs (those most predominant in SPF)

Call:

lm (formula = Y ~ X1 + X2 + … + X99, data = For_R)

Residuals:

1	–5.139e–27	**9**	9.076e–27
2	–2.421e–14	**10**	1.517e–27
3	4.483e–15	**11**	–2.057e–26
4	1.651e–14	**12**	–8.916e–28
5	–2.323e–26	**13**	7.965e–28
6	3.906e–15	**14**	–1.128e–28
7	–1.596e–15	**15**	–2.674e–28
8	–1.044e–27	**16**	1.996e–28

Coefficients (89 not defined because of singularities)

	Estimate	Std. Error	t value	Pr (> | t |)
(Intercept)	8.527e–14	5.470e–15	1.559e+01	1.97e–05***
X1	1.000e+00	1.447e–14	6.910e+13	< 2e–16***
X2	1.000e+00	1.447e–14	6.910e+13	< 2e–16***
X3	–4.120e+00	6.447e–13	–6.107e+12	< 2e–16***
X4	–7.492e–01	1.618e–13	–4.632e+12	< 2e–16***
X5	4.869e+00	8.243e–13	5.908e+12	< 2e–16***
X6	6.658e+00	3.489e–13	1.908e+13	< 2e–16***
X7	–3.780e–01	8.400e–13	–4.500e+11	< 2e–16***
X8	7.492e–01	1.556e–13	4.814e+12	< 2e–16***
X9	–7.656e+00	8.521e–13	–8.984e+12	< 2e–16***
X10	NA	NA	NA	NA
…				
X69	NA	NA	NA	NA
X70	1.000e+00	1.447e–14	6.910e+13	< 2e–16***
X71	NA	NA	NA	NA
…				
X99	NA	NA	NA	NA

Signif. codes: 0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
Residual standard error: 1.34e–14 on 5 degrees of freedom.
Multiple R-squared: 1
Adjusted R- squared: 1
F-statistic: 4.98e+33 on 10 and 5 DF
p-value: < 2.2e–16

As it can be seen from the previous calculations, there are 10 independent variables: X1 to X9 and X70 that are significant for the dependent variable (Y), which are described in the following table.

Significant Independent variables	IPC	Code description	Impact upon the equation
X1	B33Y10/00	Processes of additive manufacturing.	Positive
X2	B33Y70/00	Materials specially adapted for additive manufacturing.	Positive
X3	B22F3/105	Sintering only by using electric current, laser radiation or plasma.	Negative
X4	B29C67/00	Shaping techniques not covered by groups.	Negative
X5	B33Y30/00	Apparatus for additive manufacturing, details thereof or accessories therefor.	Positive
X6	B33Y50/02	Controlling or regulating additive manufacturing processes.	Positive
X7	B33Y50/00	Data acquisition or data processing for additive manufacturing.	Negative
X8	B33Y40/00	Auxiliary operations or equipment, e.g. for material handling.	Positive
X9	B28B1/00	Producing shaped articles from the material.	Negative
X70	G06T17/00	3D Modelling for computer graphics.	Positive

Table 6. **IPCs that Belong to the Medical Science Category from the Top 99 IPCs (those most predominant) of the Third Dataset**

#	IPCs	Code description	Number of SPF
1	A61L27/56	Porous or cellular materials.	155
2	A61L27/50	Materials characterized by their function or physical properties.	140
3	A61L27/54	Biologically active materials, e.g. therapeutic substances.	121
4	A61F2/28	Artificial substitutes or replacements for parts of the bones.	108
5	A61C13/00	Dental prostheses.	102
6	A61L27/18	Materials obtained otherwise than by reactions only involving carbon-to-carbon.	102
7	A61F2/30	Joints prosthesis.	101
8	A61B34/10	Computer-aided planning, simulation or modelling of surgical operations.	99
9	A61L27/58	Materials at least partially resorbable by the body.	85
10	A61L27/38	Animal cells (for use in artificial skin).	75
11	A61C8/00	Means to be fixed to the jaw-bone for consolidating natural teeth or for fixing dental prostheses thereon; Dental implants; Implanting tools.	70
12	A61L27/12	Phosphorus-containing materials, e.g. apatite.	61
13	A61B17/17	Guides for drills.	57
14	A61C7/00	Orthodontics, i.e. obtaining or maintaining the desired position of teeth, e.g. by straightening, evening, regulating, separating, or by correcting malocclusions.	56
15	A61F2/44	Prosthesis for the spine, e.g. vertebrae, spinal discs.	49
16	A61L27/20	Polysaccharides.	47
17	A61L27/36	Materials containing ingredients of undetermined constitution or reaction products thereof.	46
18	A61L27/04	Metals or alloys.	43
19	A61L27/52	Hydrogels or hydrocolloids.	42
20	A61B5/00	Measuring for diagnostic purposes; Identification of persons.	41
21	A61B17/00	Surgical instruments, devices or methods, e.g. tourniquets.	40
22	A61C9/00	Impression methods specially adapted for dental prosthetics; Impression cups therefore.	40
23	A61L27/22	Polypeptides or derivatives thereof.	40
24	A61N5/10	X-ray therapy; Gamma-ray therapy; Particle-irradiation therapy.	40
25	A61C7/08	Mouthpiece-type retainers.	39
26	A61F5/01	Orthopedic devices, e.g. long-term immobilizing or pressure directing devices for treating broken or deformed bones such as splints, casts or braces.	38
27	A61L31/14	Materials characterized by their function or physical properties.	38
28	A61B90/00	Instruments, implements or accessories specially adapted for surgery or diagnosis, e.g. for luxation treatment or for protecting wound edges.	37

Source: authors.

mation about the technology is scarce and there is no certainty about the commercial feasibility. In this case, the datasets show an important presence of scientific papers and patents, which convey the progress on the use of AM for the manufacturing of tablets and capsules. Among the advances displayed are the incorporation of multiple active pharmaceutical ingredients in a single tablet [*Trenfield et al.,* 2018], the use of new AM processes [*Mohammed et al.,* 2020], new formulations for fast, slow, and long-term drug delivery (biopolymers, etc.) [*Trenfield et al.,* 2018], and new designs for tablets to help with pediatric patients' compliance [*Palekar et al.,* 2019]. However, all these developments are still in an early scientific development stage and they have to go through clinical trials before they can be implemented into products.

- The T-intrauterine device is in stage 5 of the Trough of Disillusionment phase, where the product has over-inflated expectations that have been difficult to meet and, as a consequence, the product needs to readjust expectations in terms of real performance as well as commercial viability. In fact, only five scientific papers for T intrauterine devices were obtained, which presented 159 citations. On the other hand, its patenting activity showed a low score for market attractiveness (30/100), market coverage (46/100), and technology quality (33.25/100), this means that the product has little relevance on the market and low significance for the patented feature of the product.

Technological Areas of Medical Inventions of Products Made by AM

The most predominant technological areas of research in this domain were determined through multiple linear regression analysis. For this aim, the dataset of 5,847 SPFs previously obtained with the specific IPC B33Y80/00 Products Made by Additive Manufacturing from 2004 to October 2019 was utilized. Specifically,

Box 2. **Second Multiple Linear Regression Analysis**

Y (dependent variable) = the total number of patents published by year with the IPC B33Y80/00

X's (independent variables) = the IPCs that belong to the Medical Science category from the top 99 IPCs (those most predominant in SPF)

Call:

lm (formula = Y ~ X19 + X25 + X27 + X27 + X31 + X34 + X35 + X37 + X38 + X42 + X48 + X51 + X57 + X59 + X61 + X69 + X71 + X72 + X74 + X76 + X78 + X80 + X81 + X82 + X83 + X87 + X88 + X89 + X94, data = For_R)

Residuals:

Min = –0.40; 1Q = –0.40; Median = 0.00; 3Q = 0.15; Max = 0.60

Coefficients (22 not defined because of singularities)

	Estimate	Std. Error	t value	Pr (> | t |)
(Intercept)	0.4000	0.1633	2.449	0.0368*
X19	65.2167	0.4557	143.099	< 2e–16***
X25	–31.0281	0.2274	–136.457	3.10e–16***
X27	102.3690	0.6779	151.018	< 2e–16***
X31	–55.4928	0.6705	–82.761	2.78e–14***
X34	–17.6598	0.1019	–173.229	< 2e–16***
X35	–44.2762	0.3473	–127.476	5.72e–16***
X37	NA	NA	NA	NA
X38	NA	NA	NA	NA
X42	NA	NA	NA	NA
X37	NA	NA	NA	NA
X48	NA	NA	NA	NA
X51	NA	NA	NA	NA
X57	NA	NA	NA	NA
X59	NA	NA	NA	NA
X61	NA	NA	NA	NA
X69	NA	NA	NA	NA
X71	NA	NA	NA	NA
X72	NA	NA	NA	NA
X74	NA	NA	NA	NA
X76	NA	NA	NA	NA
X78	NA	NA	NA	NA
X80	NA	NA	NA	NA
X81	NA	NA	NA	NA
X82	NA	NA	NA	NA
X83	NA	NA	NA	NA
X87	NA	NA	NA	NA
X88	NA	NA	NA	NA
X89	NA	NA	NA	NA
X94	NA	NA	NA	NA

Signif. codes: 0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
Residual standard error: 0.5164 on 9 degrees of freedom
Multiple R-squared: 1
Adjusted R- squared: 1
F-statistic: 5.586e+06 on 6 and 9 DF
p-value: < 2.2e–16

As it can be seen from the second calculations, there are six independent variables: X19, X25, X27, X31, X34, and X35 that are significant for the dependent variable (Y), which are presented in the following table.

Significant Independent variables	IPC	Code description	Impact in the equation
X19	A61L27/56	Porous or cellular materials.	Positive
X25	A61L27/50	Materials characterized by their function or physical properties.	Negative
X27	A61L27/54	Biologically active materials, e.g. therapeutic substances.	Positive
X31	A61F2/28	Artificial substitutes or replacements for parts of the bones.	Negative
X34	A61C13/00	Dental prostheses.	Negative
X35	A61L27/18	Materials obtained otherwise than by reactions only involving carbon-to-carbon.	Negative

Table 7. **Stage of Development of Drug Delivery Products Produced by Means of Additive Manufacturing**

Application of Additive Manufacturing in Drug Delivery Products	Hype cycle									Results
	Innovation Trigger		Peak of Inflated Expectations		Trough of Disillusionment		Slope of Enlightenment		Plateau of Productivity	
Product	Stage 1	Stage 2	Stage 3	Stage 4	Stage 5	Stage 6	Stage 7	Stage 8	Stage 9	
Tablet	N/A	V	V	V	X	X	X	X	X	Stage 4
Capsules	N/A	V	V	V	X	X	X	X	X	Stage 4
Oral film	N/A	V	V	X	X	X	X	X	X	Stage 3
T-intrauterine device	N/A	V	V	V	V	X	X	X	X	Stage 5
Suppository	N/A	V	V	X	X	X	X	X	X	Stage 3
Vaginal ring	N/A	V	V	V	X	X	X	X	X	Stage 4
Wound dressing	N/A	V	V	V	X	X	X	X	X	Stage 4
Facemask	N/A	V	V	X	X	X	X	X	X	Stage 3
Microneedle	N/A	V	V	V	X	X	X	X	X	Stage 4

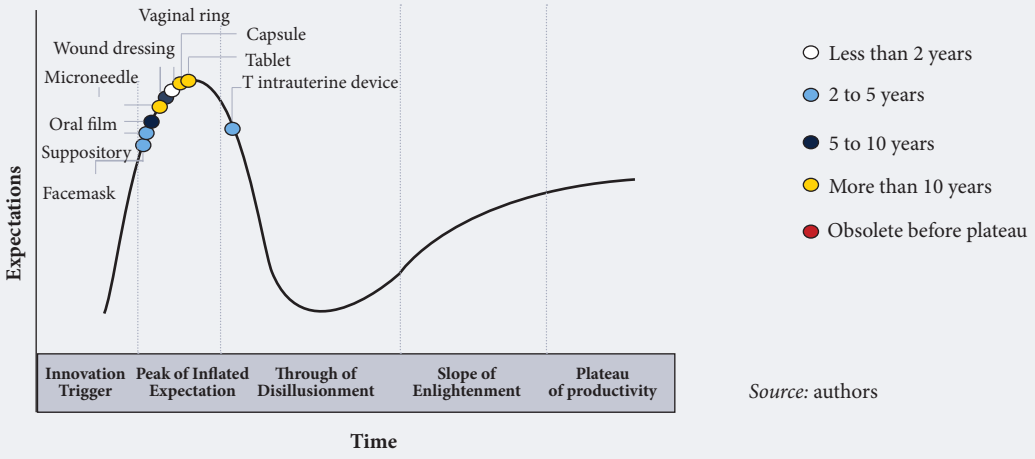
Source: authors.

the analysis was developed with the IPC B33Y80/00 Products Made by Additive Manufacturing as a dependent variable and the 28 IPCs with most SPF records that belong to the Medical Science category of the third dataset (see Box 2) as independent variables. Results from this study show that medical science where additive manufacturing processes have been incorporated focused on: A61L27/56 porous or cellular materials and A61L27/54 biologically active materials, e.g. therapeutic substances.

The IPC A61L27/56 porous or cellular materials recorded a total of 155 simple patent families. As Mazur et al establishes "Cellular materials are formed by periodic or stochastic arrangements of open or closed cell types, with either two-dimensional cell configurations (such as honeycomb) or three-dimensional polyhedral layouts (such as lattice structures)" [*Mazur et al.,* 2017]. This type of material is highly appreciated fot its unique mechanical properties as a low volume percentage of solids and small cell size, which allow for freedom of designs beyond the capability of solid materials [*Mazur et al.,* 2017; *Ulm,* 2001; *Leary,* 2018] which is so valuable for additive manufacturing purposes. Additionally, some studies have demonstrated that the control of these periodic cellular structures can help in tailoring the drug release [*Mazur et al.,* 2017].

The IPC A61L27/54 biologically active materials revealed 121 simple patent families. This kind of material comprises "materials that elicit a specific biological response at the interface of the material, which results in the formation of a bond between the tissues and the material" [*Hench,* 2005]. They provide superior advantages to diverse therapeutic applications for wound management, including the use of implantable medical devices, and the use of synthetic tissue grafts[11], this explains its importance for drug delivery products made by additive manufacturing.

Figure 1. **Hype Cycle of Drug Delivery Products Produced by Means of Additive Manufacturing**



Source: authors

[11] Available at: https://www.medtech.plus/en/trend-topics/biologically-active-materials, accessed 23.11.2019.

Through the years, additive manufacturing has grown significantly [*Basiliere et al.,* 2018]. Its evolution depends mainly upon the quality of the material to be printed (ink quality) and on the accuracy of the printing process [*Goyanes et al.,* 2019]. Recently, advances in technology have brought new opportunities for product development in many areas [*Lupeanu et al.,* 2010]. Specifically, multiple linear regression analysis shows the following as new directions for medical inventions of products made with AM: porous or cellular materials (IPC A61L27/56) and biologically active materials (IPC A61L27/54). As mentioned in the fourth stage of the methodology, products related to pharmaceutical and drug delivery are included in the medical science category. For this reason, both materials (porous or cellular materials and biologically active materials) can be considered new trends for drug delivery products made with AM as well.

To give a more specific idea of the presence of additive manufacturing in inventions for drug delivery, Table 8 shows examples of patents (all having one of both previous IPCs) that demonstrate a large amount of demand in the health industry for 1) bone repair, that includes inventions such as a scaffold that allows antibiotic infiltration, and a repairing a bracket with antibacterial properties and 2) cell transportation, which comprises inventions such as scaffolds for cells implanted that release active compositions, and scaffolds where bioactive composition controls the egress of a resident cell.

Conclusions

Additive manufacturing (AM) is gaining increasing interest in the pharmaceutical industry, specifically for reconfiguring Drug Delivery Systems (DDSs) and Drug Testing Systems (DTSs) [*Jamroz et al.,* 2018]. AM is expected to bring about major changes and transform the pharmaceutical industry by enabling the development of novel product designs, methods, applications, materials, and manufacturing processes.

Competitive and Technology Intelligence (CTI) is an important methodology for analyzing new technologies, adding value to strategic decisions for research, development, and innovation. This study presented the application of a CTI to uncover the maturity of drug delivery products created with additive manufacturing and determine the principal technology areas in medical inventions of products made using additive manufacturing. For this purpose, a hype cycle and multiple linear regression analysis were executed involving scientific documents and patents from Scopus and the PatSnap platform.

The results of the hype cycle analysis showed that oral films, suppositories, and facemasks are located in stage 3 of the Peak of Inflated Expectation phase. There is no evidence of patent activity for these products yet, the

Table 8. **Presence of Additive Manufacturing in Drug Delivery Inventions: Patent Examples for IPC A61L27/56 and IPC A61L27/54**

IPC	Patent (Organisation, Country, Year)	Abstract of Patent
Inventions for Bone Applications		
A61L27/56	US20150150681A1 — Tissue repair devices and scaffolds (New York University, USA, 2015)	The present invention relates to multiphasic, three-dimensionally printed tissue repair devices or scaffolds that are useful for promoting bone growth and treating bone fracture, defect, or deficiency. The scaffold has a porous bone ingrowth area containing interconnected struts surrounded by a microporous shell. The center of the scaffold may be empty and may serve as a potential marrow space. The porous ingrowth structure may be infiltrated with a soluble filler or carrier, such as, for example, calcium sulfate which may be infiltrated with one or more antibiotics, a growth factor, a differentiation factor, a cytokine, a drug, or a combination of these agents.
A61L27/54	CN106729988A — 3D printing bone repairing bracket with antibacterial property and preparation method of 3D printing bone repairing bracket (Guangdong Taibao Medical Devices Technology Research Institute Co. Ltd., China, 2017)	This invention belongs to the technical field of biomedical engineering, and particularly relates to skin wound dressing preparation, and involves a 3D printing bone repairing bracket with antibacterial property and a preparation method for the 3D printing bone repairing bracket. This 3D printing bone repairing bracket has a multi-layer column-shaped structure and a good three-dimensional pore structure and consists of polycaprolactone, polydopamine, and antibacterial peptide LL37. Also, it is performs well in biocompatibility, in antibacterial property, and in osteogenic capability and bone conduction capability, further, it has the function of promoting new bone tissue growth at bone coloboma parts.
Inventions for Cell Transportation		
A61L27/56	US20190254959A1 — Cell associated scaffolds for the delivery of agents (Australian Foundation for Diabetes Research, Australia, 2019)	The present invention relates to the use of scaffolds to enhance the viability of cells implanted in the integumentary system such that the cell may release an agent. The scaffold is capable of protecting the cell, as well as allowing for adequate nutrient delivery at the implant site through vascularization in and around the scaffold.
A61L27/54	US10149897 — Scaffolds for cell transplantation (Harvard University, USA, 2018)	A device that includes a scaffold composition and a bioactive composition with said composition being incorporated into or coated onto the scaffold such that the scaffold composition and/or a bioactive composition controls the egress of a resident cell or progeny thereof. The devices mediate the active recruitment, modification, and release of host cells from the material.

Source: authors

technology information is still limited, and there also few scientific papers. They have great potential as drug delivery products, but they may need more investment in research and development, especially the face masks which are used for scar treatment. Perhaps some of the lack of investment in these technologies is due to limited evidence of cost-benefit balance and their need for personalization.

Tablets, capsules, vaginal rings, wound dressings, and microneedles are in stage 4 of the Peak of Inflated Expectations phase, being the stage with the most publications and citations from all the categories. Media confer them high expectations. However, their technology is still in an early stage of development. The normal time for the development of a pharmaceutical product from bench to clinic is usually between 10-15 years [*Freeman, Dervan,* 2011]. From this group, tablets, capsules, and wound dressings are the products with more expectations and research studies. They have the most important role in drug delivery products fabricated with AM, big pharmaceutical companies such as GlaxoSmithKline and Pfizer are already involved in researching this type of product [*Clark et al.,* 2017; *Trenfield et al.,* 2018].

The T intrauterine device is in stage 5 of the Trough of Disillusionment phase, where the products need to readjust expectations, meet performance standards, and commercial viability. Since the majority of these kinds of products follow a standard design, improvements are mainly focused on their active pharmaceutical ingredients including their manufacturing process.

Globally, the results of the hype cycle show that drug delivery products are located mostly in the Peak of Inflated Expectations phase, this finding is also supported by the Gartner report "Predicts 2019: 3D printing accelerates, while 4D printing is getting started" [*Basiliere et al.,* 2018]. As mentioned previously, AM will make a significant contribution to changing the traditional pharmaceutical industry providing unique advantages such as the development of personalized medicine, control of drug release as well as the design of products with multiple active pharmaceutical ingredients [*Basiliere et al.,* 2018; *Jamroz et al.,* 2018; *Goole, Amighi,* 2016]. Even though advances are very promising, drug delivery products need to evolve more to obtain better results, meet standards, improve prices, and gain market penetration [*Basiliere et al.,* 2018]. Key challenges that need to be addressed are the lack of FDA (Food and Drug Administration) and GRAS (Generally Recognized as Safe) approved materials that can be used for pharmaceuticals and 3D printed products, manufacturing times, scale-up, process stability, and price [*Guzzi, Tibbitt,* 2020].

With regard to the multiple linear regression analysis, outcomes show that products made by additive manufacturing belonging to the Medical Science category related to drug delivery are focused on: 1) porous or cellular materials (A61L27/56) and 2) biologically active materials, e.g. therapeutic substances (A61L27/54). Both materials groups are very important to drug delivery product development. Tablets where the release is controlled depending on the porosity are a good example.

Moreover, after investigating the details of the retrieved scientific papers and patents and validating them with experts, Vat Photopolymerization and Material Extrusion were identified as the two AM technologies that have the highest impact upon the pharmaceutical applications made by AM, especially Fused Deposition Modeling (FDM) processes that belong to Material Extrusion technology. Perhaps this is due to the recent expiration of the FDM patent, allowing more companies to develop and use FDM printers at more accessible prices. Materials such as cellular materials and biologically active materials were also identified as having a high impact upon the pharmaceutical products made by AM.

In conclusion, products for drug delivery created with additive manufacturing have many advantages but they are still in development as can be seen from the hype cycle analysis. Scientific documents, patents, and expert views analysis of this research indicate that its evolution strongly depends upon the quality of the materials to be printed and the accuracy of the processes. Initial clinical applications of personalized pharmaceuticals have demonstrated that there are benefits that arise from customization [*Goyanes et al.,* 2019]. However, in many clinical settings, off-the-shelf pharmaceuticals will likely suffice. Therefore, it is important to understand when customization is appropriate.

Additionally, the regulatory approval for AM of precision medicine is not clear. The materials used to fabricate the devices should be approved following standard routes; yet, the method by which the final devices themselves can be approved is less obvious. The FDA and other regulatory bodies have provided some advice on how AM can be integrated into the approval process. However, a full regulatory path has not been defined. Thus, this makes it harder for companies to decide whether they will invest in these technologies.

In summary, the results of this study demonstrate the current state of scientific and technology behavior in the innovative domain of drug delivery and medical science where AM is present. It helps researchers make decisions that aim to incorporate new technologies such as AM. This study shows that there is a great amount of interest and R&D development in this type of product, but the technology is still in an early stage and has not passed through the disillusionment phase, which could be decisive in terms of its mass adoption

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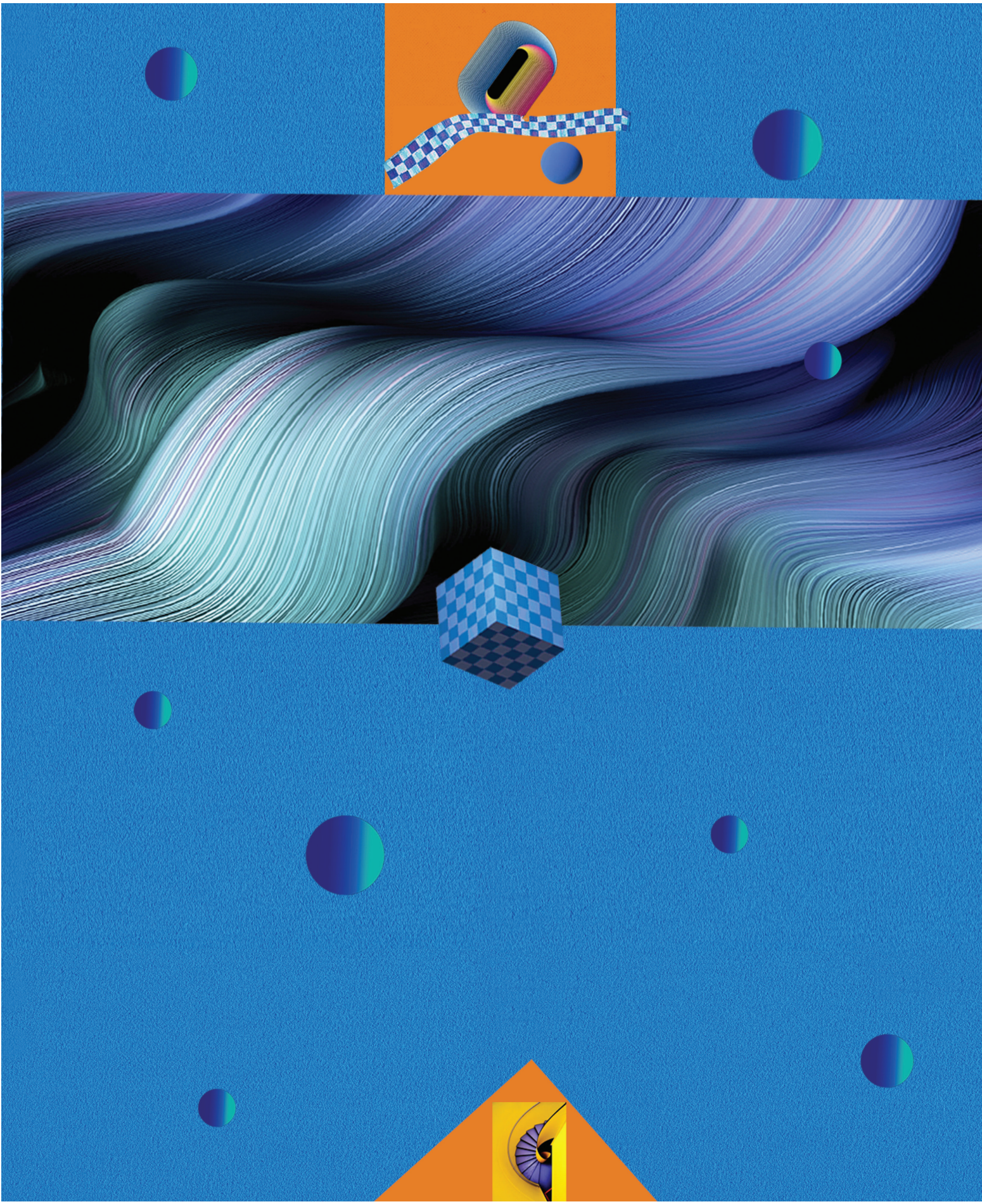

The Business Anticipatory Ecosystem outside the "First World": Competitive Intelligence in South Africa

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Abstract

The purpose of this article is to extend the Competitive Intelligence (CI) business ecosystem concept and measurements, as developed by our previous work, to South Africa. The article is based on a pioneer study on the CI business ecosystem conducted outside North America and demonstrates how the concept and measurements are applicable in other countries.

The business ecosystem view considers the state of CI both in terms of intelligence practice (by firms) and the support system that enables firm practice. For this study, measures from past studies and additional revised measures were used to examine firms' CI practice as well as CI supporting systems within government, academia, and professional associations.

Through multiple lines of research, the study noted that CI remains a practiced discipline in South Africa with evidence of the field having evolved within the country. While CI practices have grown in terms of some elements (for example, academic contribution), activities in other aspects of the ecosystem have declined such as association involvement, conferences, workshops, and training. Future research should be conducted to better understand the changes in these elements and their impact upon CI practice.

Keywords:
competitive intelligence; innovation; technologies; strategies; business ecosystem; South Africa

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Researching how organizations conduct their activities in Competitive Intelligence (CI) is a frequent area of research. In 2006, there was a survey of CI practitioners with a view to identifying how CI was being practiced [*Fehringer et al.,* 2006]. In 2020, Crayon (a CI consulting firm) and SCIP (Strategic and Competitive Intelligence Professionals — a CI association)[1] published *"State of Competitive Intelligence"*, which looked at how CI was being practiced in 2019 on the basis of a survey of CI practitioners and others, including CI users [Crayon, 2020].

Competitive intelligence in this article is defined using the definition of the Society of Competitive Intelligence Professionals (SCIP). SCIP defines CI as "a systematic and ethical process for gathering, analysing and managing external information that can affect the company's plans, decisions and operations" [Mirum, 2020]. SCIP is the international representative professional body as well as the professional accreditation body. Therefore, as this is the association that defines what constitutes CI practice for accreditation purposes, it is their definition that we use.

Du Toit [*Du Toit,* 2015] in her study of past CI research studies looked at the similarities and differences between CI definitions, trying to find a common definition. She noted that there were several different definitions but there was enough commonality to come up with a core definition of "the process or practice that produces and disseminates actionable intelligence by planning, ethically and legally collecting, processing and analysing information from and about the internal and external or competitive environment in order to help decision-makers in decision-making and to provide a competitive advantage to the enterprise." This is similar to the SCIP definition.

Using definitions similar to the one mentioned above, many researchers have developed surveys that look at how competitive intelligence is practiced. These surveys ask respondents to provide information on several dimensions of their competitive intelligence efforts including: the focus of CI projects, information collection activities, analytical techniques used, CI project management details, and the structure of their CI unit. Some of these CI practice studies are done at the global level (for example [*Fehringer et al.,* 2006; Crayon, 2020]) and some of these are done at the country level (for example a study on CI practices in Israel [*Barnea,* 2016]). Some studies are sector-focused (for example on technology firms [*Dishman, Calof,* 2008]). Some use SCIP members as their sample frame so that the study looks at firms more likely to be practicing CI, others use broad sample frames. Table 1 provides examples of the CI practice studies done.

While understanding how firms conduct CI is certainly important, this study focuses on the broader concept of the CI business ecosystem and the activities of the different organizations within this ecosystem. The business ecosystem originated with the work of Moore [*Moore,* 1993] who wrote that "a company should be viewed not as a member of a single industry but as part of a *business ecosystem* that crosses a variety of industries." In a business ecosystem, companies coevolve capabilities around a new innovation: they work cooperatively and competitively to support new products, satisfy customer needs, and eventually incorporate the next round of innovations. An ecosystem includes suppliers, dis-

Table 1. **Examples of Different CI Practice Studies**

Study	Geographic focus	Industry focus	Sample	Firms
[*Fehringer et al.,* 2006]	Global	All	550	SCIP members
[*Dishman, Calof,* 2008]	Canada	Technology	1025	All sizes
[*Nasri,* 2011]	Tunisia	Communication & technologies; Manufacturing; Retailing	8	Large
[*Du Toit, Sewdass,* 2014]	Morocco	All	25	All sizes
[*Sewdass, Du Toit,* 2014]	South Africa	All	24	All sizes
[*Sewdass, Du Toit,* 2015]	Brazil South Africa	All	37	All sizes
[*Barnea,* 2016]	Israel	All	39	Large
[*Garcia-Alsina et al.,* 2016]	Spain	Education	14	Large
[*Munoz-Canavate, Alves-Albero*, 2017]	Spain	All	47	Large
[*Drieman,* 2018]	Global	All	408	All sizes
[*Calof et al.,* 2018]	Europe	All	156	All sizes — generally SCIP
[Crayon, 2020]	Primarily North America	All	1000	All sizes

Source: authors.

[1] Available at: www.scip.org, accessed 29 February 2020.

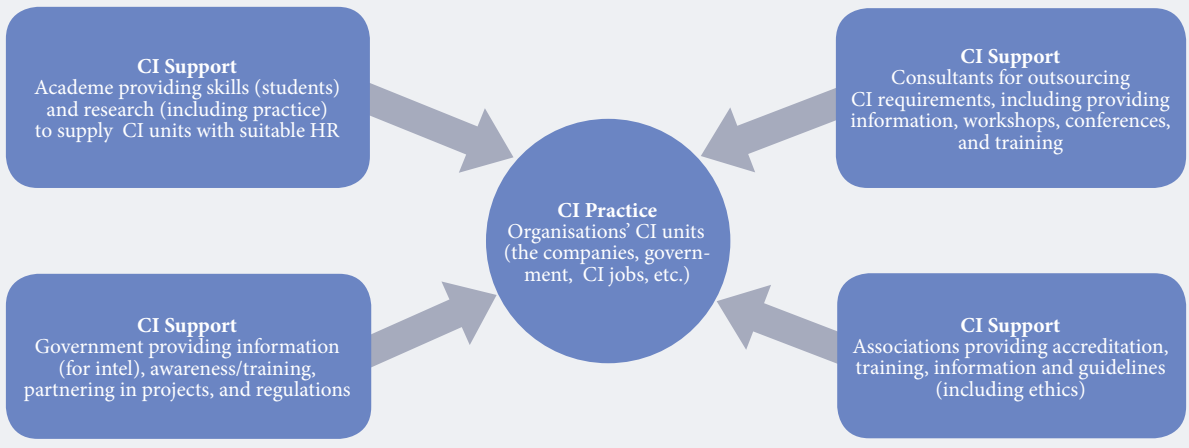
tributors, consumers, government, processes, products, and competitors. Being a part of a business ecosystem provides mechanisms to leverage technology, achieve excellence in research and business competence, and compete effectively against other companies. Organizations in a business ecosystem are involved in the delivery of a specific product or service through both competition and cooperation [*Hayes,* 2019]. The idea is that each entity in the ecosystem affects and is affected by the others, creating a constantly evolving relationship in which each entity must be flexible and adaptable in order to survive as in a biological ecosystem. Several other studies also found the ecosystem concept useful for their specific environments, for example [*Hult et al.,* 2020, p. 38] defined the international business ecosystem as "the organisms of the business world — including stakeholders, organizations, and countries — involved in exchanges, production, business functions, and cross-border trade through both marketplace competition and cooperation."

It is our view that past studies, by focusing only on examining the CI practices of companies that practice competitive intelligence, miss out on those elements of the business ecosystem that are required to reinforce this CI practice. For example, academic research helps create new CI practices and university CI courses can help to develop practitioners. Glitman stated "Academic excellence and practical knowledge are key drivers in the advancement of the competitive intelligence profession" [*Glitman*, 2010]. Academia also supports CI practice by providing CI executive educational programs [C*alof, Vibert,* 2018]. In competitive intelligence, SCIP (CI association) provides practicing firms with standards (body of knowledge, certification), materials to help with setting up intelligence structures, training, conferences, ethical guidelines, and so forth. The CI business ecosystem has supporting businesses — service providers, for example consulting firms that CI practitioners turn to for outsourcing CI projects or elements of the intelligence process. Figure 1 is a graphical representation of the CI business ecosystem concept being studied in this paper.

This broader view of the competitive intelligence business ecosystem is evident in how SCIP describes and classifies its members: competitive and market intelligence professionals, solutions providers, professors, students, and non-profit experts. The Crayon report classifies respondents as CI consultant, CI practitioner (CI is part of their role), and CI user [Crayon, 2020]. Further, asking CI practitioners if they use elements of the business ecosystem is common in CI practice surveys. For example, Fehringer et al. asked participants about their use of consultants (outsourcing research or analysis), acquisition of information (from outside vendors), and about training [*Fehringer et al.,* 2006]. Yet despite this (the business ecosystem questions in surveys, association classification of business ecosystem in membership) most CI studies have focused only on understanding the organizations that are practicing competitive intelligence, the firms and not the CI business ecosystem. Only two Canadian studies were found that looked at the CI business ecosystem [*Calof, Brouard,* 2004; *Calof, Vibert,* 2018]. It is this gap in the literature that we seek to fill. To broaden the application of the CI business ecosystem beyond Canada.

The initial concept and measurements for the CI business ecosystem were developed in Canada [*Calof, Brouard,* 2004]. These were further refined in [*Calof, Vibert,* 2018]. While many of the concepts and measurements in the 2004 study were used in the 2018 study, several new measures were added in

Figure 1. **Competitive Intelligence Business Ecosystem Linking CI Practice and Support Variables**



Source: authors.

Table 2. **Concept and Measurement of the CI Business eEcosystem**

	[*Calof, Brouard,* 2004]	[*Calof, Vibert,* 2018]
Ecosystem variable	**Concepts and Measurement**	**Additional/revised measures and concepts from 2004 study**
Ecosystem: CI practice		
	• Extent of corporate CI practice (from past surveys and expert panel) • Descriptions of federal and provincial government CI programs (historical review and expert panel)	• Number of help-wanted ads in Canadian job search engines mentioning CI • Number of LinkedIn profiles mentioning CI • Existence of government (provincial and federal) CI programs search using government search engines
Ecosystem CI support		
Consultants	• Names of academics as consultants • Description of consulting firms • Names of independent consultants • Training programmes on CI • Expert panel	
Academic	• Academics in Canada involved in CI — From industry consultation, SCIP members database, and academic journal search engines • Number of research contributions — Industry consultation and academic publication search engines • Names of universities and colleges with courses for students on CI — Industry consultation • Universities and colleges with courses for practitioners on CI Industry consultation	• CI streams in Canadian academic conferences — Industry consultation • Number of names of Canadian CI academics recognized in international rankings — Article review, Industry consultation • Courses that include CI in them — Industry consultation • Changes in methodology • Courses found by searching websites of Canadian universities
Government CI support	• Identification of government programs/agencies that provide information and intelligence to other firms • Provision of CI training and conferences for Canadian firms • Joint intelligence programs • Industry consultation	• Searching for articles about government CI programs • Role conceptually broken down into CI partner (joint projects), skills builder (offering training • Methodology addition: Government search engines
CI association	• Number of SCIP members (SCIP members database) • Number of SCIP chapters (SCIP website • SCIP events (SCIP website and consultation)	• Special Library Association CI division membership

Source: authors.

an attempt to obtain more in-depth insights. For example, in looking at CI practice (firms and government), the researchers expanded their measurement to include competitive intelligence jobs. The CI association went beyond SCIP to include CI-related associations like the Special Librarians Association (SLA) CI division. Table 2 provides the CI business ecosystem variables used in the 2004 study and the additions/changes made in the 2018 study.

The 2018 study made greater use of online sources of information than the 2004 study did, including government search engines and job search engines, as well as broader academic article search engines. The study reported on in this article seeks to use the concept of the competitive intelligence business ecosystem to study and provide readers with details of the CI business ecosystem in South Africa. In addition, as this is the first study on the CI business ecosystem in Africa — and South Africa specifically — the article seeks to enhance the generalizability of the concept and its measurement.

Overview of Study Methodology

In adopting the broader CI business ecosystem view of competitive intelligence, this study looks at the various elements of the CI business ecosystem, each with its own separate methodology. These methodologies are described in detail in the appropriate sections of this article. This section provides an overview of the methodologies used. In general, however, the methodology used is consistent with the Canadian studies mentioned earlier.

To explore how South African firms practice competitive intelligence, a review of studies in the past few years was conducted on South African firms' CI practices. In addition, this article reports on South African firm results from the global CI study described in [*Calof et al.,* 2018]. A review was also conducted on CI activities in government by doing a web search of South African national and regional government websites. CI jobs were examined by searching South African job search engines and LinkedIn profiles.

The South African academic contribution to CI was researched using multiple approaches. CI research was examined by searching academic article databases (for example, Scopus, Web of Science EDS and ProQuest) for peer-reviewed research articles written by academics in CI. University CI courses were examined by going to all South African post-secondary institutions' websites and searching for CI courses.

CI consultants were identified by searching the internet and using an expert panel.

Training courses, workshops and conferences as found in the Canadian study can be associated with association activity, consultants, and academe therefore to identify courses, workshops, and conferences, the expert panel was consulted and searching on the internet was done.

To identify government involvement in competitive intelligence including both CI practice and support, government search engines were used, examination of government websites, and consultation with the expert panel.

For the most part, these variables and their measurement are similar to those used in [*Calof, Brouard,* 2004; *Calof, Vibert,* 2018]. For more detail, see the methodology section for each part of the CI business ecosystem.

Readers will note several anecdotal and qualitative statements concerning CI associations, CI conferences, and other CI infrastructure elements. These were generated during an expert panel discussion involving a group of acknowledged South African CI experts. This group included:

1) One of South Africa's first CI consultants;
2) A South African CI academic acknowledged to be one of the top CI publishers in the country who was also a SCIP chapter chair for many years, a SCIP board member, and a board member of the African Economic Intelligence Forum;
3) A South African academic associated with early research on CI in South Africa who was also involved in the founding of the first SCIP chapters in South Africa.
4) A foreign professor who is an adjunct professor at a South African university. The foreign professor helped to start the Cape Town and Johannesburg SCIP chapters and participated in many of the early conferences in South Africa. Additionally, the foreign professor provided training at South African companies and government agencies and was among the first academics to study South African competitive intelligence practices.

CI Practices in Firms

The CI practice of South African firms was studied in two ways. First, a review was conducted of those studies that looked at CI practices in South Africa. Only those articles published in the years 2014–2019 were used so as to ensure that only recent practice was reflected. Secondly, South African firms were sent a survey designed to identify their CI practices.[2] As there were few SCIP members in South Africa (the primary sample frame in the global study was SCIP members), the survey was administered at a CI conference held at the University of South Africa (UNISA) in Pretoria and also sent out to those who the researchers knew had CI units. Since there is "no recognized list of practicing CI professionals" in South Africa [*Muller, Viviers,* 2004], the universe is not known. To determine the situation with relation to jobs, help-wanted advertisements were searched using the expressions "competitive intelligence" or "market intelligence" or "business intelligence" in the job title or as a key responsibility. The jobs searched for therefore had to involve CI or had to have CI in the job description. The exact phase "competitive intelligence" was then used to determine how many persons have CI in their job title.

Who is Practicing Competitive Intelligence?

CI has long been recognized in South Africa as a strategic management tool that can enhance competitiveness [*Sewdass, Du Toit,* 2015] and many South African firms have been found in past studies to be practicing CI to survive in the midst of intense global competition [*Sewdass, Du Toit,* 2014]. The Industrial Classification, as discussed in the study by [*Fehringer et al.,* 2006, p. 122] was used in the current survey to determine the various sectors that the respondents came from.

In terms of the kinds of companies that practice CI, in South Africa, CI was mainly practiced by "for-profit" firms, with limited evidence of CI being practiced by non-profit organizations [*Sewdass, Du Toit,* 2014]. Respondents in their study came from the following sectors: Financial, insurance, real estate and business services (25%); Agriculture, hunting, forestry and fishing (15%); Electricity and water supply (10%); Tourism (10%); Oil and gas (10%).

The survey of CI practices (which is referred to in this section as the 'current survey') noted that the respondents came from a broad range of industries, including: Financial (20%); Consumer goods and services (14%); and Telecommunications (10%). Government respondents were also represented (14%) as were those in education (10%).

In terms of firm size, it was mainly the larger firms with more than 500 employees (50%) that were practicing CI [*Sewdass, Du Toit,* 2014]. However, they did note that smaller firms with fewer than 50 employees were also practicing CI (10%). The practice of CI by smaller enterprises in South Africa was also noted by [*Nenzhelele,* 2016]. The current survey found that 14% of the firms practicing CI had fewer than 50 employees, 14% had between 50 and 249 employees, 19% had between 500 and 1,000 employees, 29% had between 1,000 and 10,000 employees, and 24% had more than 10,000 employees.

[2] The survey design and testing approach as well as the methodology for the study are also described in detail by [Calof et al., 2018]. A copy of the survey can be obtained from the corresponding author.

How Formal is CI Practice?

The studies [*Sewdass, Du Toit,* 2014, 2015] found that the majority of respondents (60%) had a formal CI function at their firms that had been in existence for five years. However, they reported that there appeared to be a degree of complacency and self-deception that was inhibiting managers from implementing effective plans to improve their CI. Few conducted CI in a formal, systematic manner or had actual plans to improve their ability to keep track of competitors with a view to enhancing their competitiveness.

In the current survey, 86% of the respondents indicated some kind of formal CI structure. Of these, 43% said that it was centralized, 14% said that it was decentralized and 29% said it had a mixed structure (a structure in which some activities were centralized and some intelligence activities were performed independently by other departments). The most frequently mentioned units responsible for CI-related activities were market insight (29%), marketing or marketing research (29%), strategic planning (24%), and CI (19%).

One-third of respondents indicated that they had more than one unit at the firm performing CI and CI-related activities. CI units had been in existence for between six and ten years. In terms of the structure of the CI unit, the recent study reported that they had on average 2–4 employees, 52% had a formal CI strategy, 62% had formal CI procedures, 57% had ethical guidelines specifically for CI activities, and 62% had a manager with CI responsibilities.

How is CI Practiced?

According to [*Sewdass, Du Toit,* 2014, 2015] it was reported that South African intelligence practice had the following characteristics:

- CI was focused on government legislative trends (50%), on decision-making (25%), on helping to quantify/qualify strategic sources (20%), and on monitoring competitor actions (17%).
- The most prominent secondary sources used for CI include information on regulatory bodies, promotional materials, internal financial information, and corporate websites.
- The most prominent primary sources used in South Africa for CI include industry experts, direct customer feedback, company employees, and staff who attend conferences and seminars.
- The most frequently used analytical methods or models were industry analysis (50%) and SWOT analysis (50%), followed by GAP analysis (35%), benchmarking (35%) and competitor analysis (35%).
- The methods used to distribute and present CI findings were presentations (27%), e-mail (27%), reports (23%), personal delivery (23%), and briefings.

These findings were largely confirmed by the study [*Nenzhelele,* 2016] on CI practices of small South African firms in the property sector. Customers were the respondents' main source of information for CI. Teamwork and brainstorming, a SWOT analysis, and valuation techniques were widely used by the real estate agencies to analyze the collected information. Respondents indicated that the preferred methods for disseminating the intelligence developed was through face-to-face meetings, e-mails, and presentations.

The study [*Du Toit,* 2015] revealed that large sums of money are already being spent on the processing and retrieval of information about the external business environment (including but not limited to customers, competitors, government, and technology). However, this does not mean that the quality of external environmental business information systems in South Africa is adequate, since only 28% of the respondents indicated that they had a formal environmental scanning system. Environmental scanning is a systematic process of determining the information needs of managers, making sure that the right information is collected and analyzed and applying the results in the strategic planning process [*Du Toit,* 2015]. This means that relatively little formal environmental scanning was undertaken by South African firms. In the current survey, when respondents were asked the percentage of time allocated to different parts of the external environments, the highest scores related to customers (36% of CI time) and competitors (18% of CI time).

The current survey has several questions that ask about the CI focus (intelligence topics), collection sources, analytical techniques used, how intelligence was communicated, and how intelligence activities were managed. The findings revealed that, overall, 20% of intelligence time was spent in planning-related activities, 27% in collections, 22% in performing analytical activities, 11% in communicating the results, and 20% of time devoted to CI projects was spent in CI management activities, including evaluation. In terms of planning, the CI focus was predominantly to help make corporate or business decisions of a strategic nature, followed by decisions concerning market entry and sales and business development. Consistent with this, CI focused on market and industry reports and company profiles.

In terms of collection activities, the current survey found that the internet and customers were the most important sources of information for the respondents. However, most of the information sources were viewed as important to the respondents, with nine out of the eleven sources averaging between 2.7 and 3.2 in terms of importance on a four-point scale, with zero being not important and four being very important (internet, customers, publications, industry experts, internal databases, company employees, commercial databases, social media, and suppliers

being at 2.7 to 3.2; government employees and association employees being at 2.3 and 1.9).

In terms of analysis, 84% of respondents indicated that they did some formal analysis, with the average number of techniques being 4.4. The most frequently used technique was SWOT (strengths, weaknesses, opportunities, and threats) analysis. The top five techniques noted were SWOT, followed by competitor analysis, financial analysis, bench-marking, and scenario analysis. Customer satisfaction (the users of CI) was the top method used to evaluate CI.

Jobs in CI

To assess "CI jobs", a web search of job advertisements was conducted in February 2020. Help-wanted databases were searched that had jobs containing the expressions "competitive intelligence" or "market intelligence" or "business intelligence" in the job title or as a key responsibility. "Market intelligence" and "business intelligence" are used rather than just "competitive intelligence" because these other expressions were noted in other parts of this study. For this web enquiry, the authors used the phrase "Competitive Intelligence" first with the phrase "South Africa" and then with the names of each of the nine provinces in South Africa. The enquiry was done on February 18, 2020 on three job sites, i.e. CareerJet, LinkedIn.za, Indeed.Za, and PNet.co.za. The jobs searched for therefore had to involve CI or had to have CI in the job description. The first 200 job advertisements on each of these websites were analyzed, meaning that a total of 800 profiles were analyzed.

In order to widen the search, the authors also used the phrases "Competitor Intelligence" and "Market Intelligence" in conjunction with "South Africa" on the job sites LinkedIn.za, Indeed.Za, and PNet.co.za.

Finally, to determine the number of people who are currently practicing CI, LinkedIn was searched to identify people who have the exact phrase "competitive intelligence" in their title. The search phrase "competitive intelligence manager" was entered, together with Johannesburg, Durban, Pretoria, or Cape Town (the four main economic hubs in South Africa). The reason for entering these hubs is that the search would yield more accurate and narrower results. The first 200 LinkedIn profiles on each of the hubs, i.e. a total of 800 profiles, were scanned to extract those that had "competitive intelligence" as an exact phrase in their job titles. The results are summarized in Table 4. No job classification was used; rather, jobs databases were searched using specific terms. These terms would generate results which included job titles. These job titles would be the ones written by the hiring organization or the hiring company.

The majority of CI and CI-related job opportunities appeared in the main economic areas in South Africa, i.e. (in terms of population number, descending order) Cape Town, Durban, Johannesburg, and Pretoria.[3] Only a few of these were for jobs with CI in their title. However, most had CI as part of the skill requirement or job development and most job names were related to business development, market insights, and strategic management. To a lesser degree, information specialist/knowledge management jobs were found in the search.

The job searches on each site resulted in around 20 jobs each. On Indeed and CareerJet, the job search yielded 23 and 20 jobs respectively in South Africa which had CI in the job description and/or title. PNet yielded 19 results using the same phrases and words. There was overlap and so it is not possible to state that these jobs were unique. Using the results of Indeed, most of these jobs (13) were in Gauteng, seven in the Western Cape, and two in KwaZulu-Natal. A similar number dispersal was found in the results for PNet and CareerJet. The industries in which CI featured most in the job descriptions were banking and finance, manufacturing, pharmaceuticals, and services.

The results indicate that CI is pervasive but is notable for being a demarcated by specialization. The Indeed.co.za findings point to CI in job descriptions in a variety of industries. The industries featuring most prominently in the results were (in order of descending size) engineering and automotive (6), banking and finance (2), real estate (3), logistics (1), ICT (3), and retail/FMCG (3). Jobs with CI as a key responsibility were also available in human resources, public sector, utilities, and mining. Many of the jobs had the words market, sales, or marketing in their title. A similar pattern was found on PNet.co.za and CareerJet using the same methodology.

While the jobs identified in the research did not contain the phrase "competitive intelligence" in their title, the description in the key responsibilities all pointed to the incumbent having to understand or monitor or collect from and analyze the competitive landscape. The key responsibilities on Indeed, PNet, and LinkedIn all included "competitive intelligence" or competitors/competitor intelligence/competitive analysis and also contained the following descriptions: Market and CI; track CI and monitor competitor activities. The most prominent job titles that had CI among the key responsibilities are:

[3] Available at: www.geonames.org/ZA/largest-cities-in-south-africa.html, accessed 8 February 2020

Table 3. **Job Titles Containing the Phase "Competitive Intelligence"**

Job Title	Industry	Location
Competitive Intelligence Manager Providing CI services at a large financial company	Banking	Johannesburg
Competitive Intelligence Manager Competitor analysis for a large bank	Banking	Johannesburg
Competitive Intelligence Analyst Commissioned CI research for the market	Consulting	Johannesburg
Competitive Intelligence Analysis Expert Group CI services — competitor and trends analyst	Pharmaceutical	Johannesburg
Manager**:** Competitive Intelligence Provides CI services to the market	Consulting	Johannesburg
Competitive Intelligence Analyst CI services to client base of a large auditing firm	Auditing	Johannesburg
Competitive Intelligence Analyst Environmental scanning and competitor analysis	Consulting	Cape Town

Source: authors.

- Marketing Representative
- Executive Head: Research & Insights
- Senior Business Analyst, Projects and Market Insights
- Chief Executive Officer
- Regional Manager
- Business Analyst (Strategy)
- Area Sales Manager
- Intelligence Processor
- Strategist: Strategy and Research
- Marketing Manager
- Sales/Outside Sales Representative
- Senior Account Executive
- Consumer Account Manager — SADC
- Public Sector Partnership Support
- Business Development Manager

With specific reference to CI practitioners, i.e., incumbents with the job title CI analyst or CI manager/practitioner on LinkedIn, there were only seven jobs nationally with that exact title. Whereas Johannesburg and Cape Town yielded seven results on February 18, 2020 (see Table 3), in Pretoria and Durban (capital of KwaZulu-Natal province) there was not a single person that had CI in their job title.

Table 4. **Mentions of "Intelligence" Services on Provincial Government Economic Development or Trade Promotion Websites**

Location	Agency	Website	Description of relevant services
Eastern Cape	Eastern Cape Development Corporation	ecdc.co.za	"Economic Intelligence" in support of its core business areas [ECDC, 2020]; "market intelligence" for exporters
Free State	Free State Development Corporation	fdc.co.za	No mention of the word "intelligence" on the FDC
Gauteng	Gauteng Growth and Development Agency	ggda.co.za	It has a "Business Intelligence and Planning business unit" with its main service being "to improve the GGDA and the province's ability to conceptualise and implement targeted initiatives that will grow the key sectors and sub-sectors of the economy and accelerate inclusive economic growth"
Limpopo	Limpopo Economic Development Agency	lieda.co.za	LIEDA's mission is "to provide business intelligence and research and development towards innovative solutions to develop scenarios and business intelligence, monitor and evaluate the impact of projects, provide capacity support in areas of development such as economic development research; be a first point of call in terms of business and market intelligence"
Mpumalanga	Mpumalanga Economic Growth Agency	mega.gov.za	MEGA's Trade and Investments Division provides international market information, intelligence and research. Trade advisors have market intelligence and research as part of their key responsibilities
Northern Cape	Northern Cape Economic Development, Trade and Investment Promotion Agency (NCEDA)	nceda.org.za	As part of its trade development and promotion services, the economic development agency "supported by intelligence, will provide businesses with a 'package' of support to maximise opportunities that assists Northern Cape clients meet the challenges and manage the risks of doing business in international markets"
North-West	North-West Development Corporation	nwdc.co.za	No mention of the word "intelligence" on the NWDC website
KwaZulu-Natal	Trade and Investment KwaZulu-Natal	tikzn.co.za	Trade and Investment KwaZulu-Natal provides sector intelligence following a multi-method approach within a business-to-business and business-to-consumer market
Western Cape	Cape Town and Western Cape Tourism, Trade and Investment	wesgro.co.za	"Business intelligence generated by its research teams to provide the leads for engaging with foreign embassies, consulates, high commissions, stakeholders and chambers of commerce — locally and abroad"

Source: compiled by the authors using data from the agencies' official websites (accessed 03.03.2020).

Many results, despite not having CI in the job title, do list competitive intelligence as a skill. However, this does not necessarily mean that the job requires skills in CI; it might be more about the person's skill set than a job requirement. The fact that jobs in South Africa that had CI in the job title were so few (7), but using the words competitor, competitive, and intelligence in a wider search yielded more results, point to the fact that CI is practiced more widely and in jobs that have titles other than the phrase Competitive Intelligence.

Summary of CI Practices and CI Jobs in South Africa

When comparing the CI practices of South Africa with those of other developing (emerging) countries such as Malaysia, Morocco, and Brazil, it was noted that CI practices were more mature in South Africa [*Sewdass, Du Toit,* 2014]. Analytical methods used in South Africa were more varied than those used in the other developing countries, which relied heavily on SWOT analysis and customers. However, when comparing the past studies on CI practices in South Africa with the current survey, it is interesting that SWOT analysis, competitor analysis, and benchmarking still remain the most frequently used techniques in South Africa.

The financial industries still dominate the sector where CI is practiced in South Africa. CI is also still practiced mainly by large companies with more than 500 employees (72%), while the companies with fewer than 50 employees still continue to practice CI (14%) in the current survey compared to 10% in previous studies. Thus, compared to studies of CI practice in other developing countries, it appears from the research that South African firms have more formal intelligence systems.

Also, in comparing past research with the current survey, it appears that CI is growing in South Africa, with more formalized practices. Finally, it is evident that as CI activity grows, the units responsible for it are becoming more diverse (market insight, for example, being the dominant unit name) with more and more firms having multiple units responsible for CI activities. CI jobs are found in all industries. While only few job titles contain the exact phrase "competitive intelligence" there is evidence of CI being practiced widely in jobs with various titles (see Table 3).

CI Practices in Government

The methodology used to assess CI practices in government involved a web search using the search terms "Competitive Intelligence" and "government" and "South Africa", as well as "Competitive Intelligence" and the names of the various trade and investment promotion organizations, including the largest state-owned enterprises (SOEs). The SOEs selected were those known to have CI practices. It should be noted that in South Africa, each of the nine provinces has a trade and investment promotion organization/agency. Each province, in turn, has a government economic department and/or a trade and investment-type organization as well as chambers of commerce funded through public and/or private funds. Over and above doing a general internet search, the authors also researched the websites of the economic development or trade and investment promotion organizations/agencies in all nine provinces.

In examining CI in government, the authors looked at two aspects: firstly, whether CI is practiced at the government level, and secondly, whether there is any government support for CI as a business discipline in South Africa. The latter was emphasized in a study [*Pellissier, Nenzhelele,* 2013] which found that CI is a critical success factor in the case of for-profit and non-profit, large and small, public and private firms.

In South Africa, the influence of the state in economic activity is particularly strong; hence, aggressive sponsorship of and the commitment of government leaders to CI campaigns and activities are crucial [*Strauss, Du Toit,* 2010]. Historically, however, the word "*intelligence*" has had negative connotations since South African intelligence activities were conducted by state institutions that were part of the apartheid machinery. Indeed, many of the first generation CI professionals and early consultants came from the National Intelligence Service, military intelligence, and government. This is similar to early CI consultants in the rest of the world who acquired their intelligence skills in formal government intelligence structures.

Moving the focus to whether CI is practiced at a government level, the results point to the fact that intelligence as a wider concept is still largely seen as a political and military effort in government departments in South Africa. There is some anecdotal evidence of intelligence being associated with competitiveness in some government documents, such as the South African Yearbook 2018/19 [GCIS, 2019]. However, when a search is conducted on the South African government websites using the term "competitive intelligence", there is no emphasis on CI at any government level – national, provincial, or local – the emphasis is upon security intelligence and risk, and not on CI. Several departments including for example the Department of Trade and Industry (the DTI) and the Department of Agriculture, Forestry and Fisheries have CI programs and have undergone training including amongst others Trade Show Intelligence on an ad hoc basis. Within the DTI there is similar evidence of CI initiatives in the Industry and Export Associations. These initiatives are however not at a sufficient level to have resulted in department policies around them and therefore

would not appear in a department policy search. Nevertheless, the expert panel was aware of several of these ad hoc CI initiatives within the government.

The government intelligence focus mainly relates to vulnerability assessments, security risk management, governance, compliance, and corporate investigations aimed at ensuring systematic and coordinated analysis, and also highlighting the threats the firm faces, its inherent vulnerabilities, and appropriate counter and control measures for minimizing risks, both in the physical and the cyber security domains[4] [*Duvenage,* 2020].

This is not to suggest that there is no purpose for CI at the various government levels (national, provincial, and local) as countries, provinces, and municipalities do compete for scarce resources and particularly investments (including foreign direct investment and associated skills). As mentioned, all nine provinces in South Africa have an economic and/or trade and investment organization/agency (within the specific provincial government structures). On the business and trade promotion organization level, the role and value of intelligence are more evident. All but two of these organizations mention CI, market intelligence, and/or business intelligence on their websites as part of the service rendered to their stakeholders (see Table 4).

The head of research at the Western Cape economic development agency (Wesgro)[5] [Wesgro, 2020a], in a discussion with the author, indicated that Wesgro has CI services focused on market and industry research and that the Western Cape, Gauteng, and KwaZulu-Natal are the leading provinces in terms of market and business intelligence research services. These trade and investment organizations, however, emphasize that the research provided does not contain covert and sensitive competitor information because they need to remain impartial and also that their time and resource limitations do not permit this type of research for CI purposes.

At state-owned enterprises (SOEs) like the CSIR (Council for Scientific and Industrial Research, which is South Africa's central and premier scientific research and development organization), Denel (the largest manufacturer of defense equipment in South Africa), Telkom (an information and communications technology services provider in South Africa), Eskom (South Africa's public electricity utility), and SAA (the national airline), CI is practiced.

These SOEs traditionally had some of the largest CI units in the country. Eskom has a job advertisement on its website for a Senior Analyst Business Intelligence stating that the specialization is "to provide commercial intelligence through the Business Intelligence department with business and data analytics, procurement scorecards, market research, benchmarking, competitor identification screening and analysis, threats, and identification analysis"[6] [Eskom, 2020]. In 2013, Eskom had 10 members that belonged to the SCIP South African Chapter. Eskom paid for the membership of its employees. This was indicative of the commitment of the company to practicing CI.

CI Support Activities

Academe

South African scholarly articles were identified by searching a variety of academic databases, including Google Scholar, Scopus, Web of Science, EDS, and ProQuest. This is similar to the methodology used by [*Calof, Brouard,* 2004] (see Table 2), which used the ProQuest and ABI Inform search engines to search for scholarly academic articles. These searches were conducted in February 2020. Keywords that were used were "South Africa" and "Competitive Intelligence" (CI).

These articles were then examined to ensure that the subject matter was competitive intelligence and that the author(s) was/were from South African institutions. This resulted in both a list of articles and a list of authors. This list of articles and authors was then sent to prominent South African CI researchers who were asked if they were aware of other publications or articles written by academics based at South African universities. With a validated list of those CI researchers/academics who had studied and published in competitive intelligence, the researchers then went back to the academic databases and searched for all publications from these authors to identify additional CI publications that each had published. The emphasis in this phase was to be as complete as possible in terms of identifying articles about CI from academics at South African research institutions (see Table 2).

The second part of the academic contribution to CI was to identify which institutions taught competitive intelligence – in a sense, the extent to which academic institutions were training CI practitioners. To this end, an examination was conducted of the websites of all 26 public universities and the seven universities of technology (formerly known as technical colleges or technikons) in South Africa. The search phrase "Competitive Intelligence" was used and the latest yearbooks (2020) and curricula for undergraduate and postgraduate programs were examined. South Africa's 26 public universities are all members of Universities South Africa. The web

[4] Telephone interview, February 8, 2020.

[5] Interview with Head of Research. (Personal communication, 27 February 2020).

[6] Available at: https://secapps.eskom.co.za/sites/Recruitment/Pages/Senior-Analyst-Business-Intelligence(Megawatt-Park).aspx, accessed 12 February 2020.

search was intended to establish whether CI is currently offered as a course at higher education institutions (see Table 2).

The research results relating to scholarly works on "Competitive Intelligence in South Africa" (1995–2019) can be summarized as follows:

- Between 1999 and 2017, there were 88 articles published in peer-reviewed academic journals by academics from South African research institutions.
- Ten academics had two or more articles, with the most articles coming from the following researchers: Muller, M.L. (33 — North-West University and IBIS Consulting), Viviers, W. (21 — North-West University), Du Toit, A.S.A. (18 — UNISA and University of Pretoria), Nenzhelele, T.E. (10 — UNISA) and Sewdass, N. (9 — UNISA). Many of these articles were jointly written by two or more of the authors and therefore the total of 108 in Table 6 is more than the total number of articles of 88.
- In terms of the focus of South African CI academic scholarship, 39 of the articles were of the country CI variety (looking at how CI is practiced in different countries or comparing countries to identify differences in CI practice).
- Thirty-one of the articles looked at CI practice in different sectors — thus industry-focused CI research (for example, how pharmaceutical companies practice CI) or a specific company (case study).
- Twenty-three of the articles were focused on CI literature reviews (defining competitive intelligence and the domain).
- Nine of the articles looked at CI skills requirements.
- The remaining six articles looked at the interplay of knowledge management and competitive intelligence.

In terms of teaching-related activities, from 1995 to 2020 there were 13 PhD theses and four Master's dissertations completed on CI in South Africa. There were six universities involved in supervision. The universities that conferred most of these degrees were: North-West University (5), University of Johannesburg (5), University of Pretoria (2), and University of the Witwatersrand (2).

CI as a course was first taught in South Africa in 2002 at one higher education institution. As of the study date, four higher education institutions offer some formal academic courses from undergraduate (Bachelor's degree) to postgraduate (Honours, Master's and PhD) level and also at the certificate level. CI courses in South Africa are mainly offered as part of the curriculum in the Department of Information Science, the Department of Information and Knowledge Management, and the Department of Business Management.

The University of Pretoria was the first academic institution to recognize the need for formal academic training in CI. CI as a study field, with close links to information science and knowledge management, was offered at postgraduate and certificate levels by the University of Pretoria's Department of Information Science in 2002. It was taught by a consultant for the first two years. It was then developed and has been taught internally since then by university faculty with courses offered at both undergraduate and postgraduate levels. The aim of the course is to provide practitioners and students involved in this field with the necessary skills to contribute to the competitiveness and intellectual capital of their firms.

Similarly, the University of Johannesburg started teaching CI with consultants initially developing and presenting a short course in CI from 2003 until 2009. The university then started presenting in-house, as is still the case.

Tshwane University of Technology (TUT) offered CI as part of their Advanced Knowledge Management course, which is a module in the Bachelor of Information Technology (BIT): Technology Business Applications qualification.

Table 5 summarizes CI in academia and the scholarly contributions and details of university CI courses.

From the total of 88 articles published in the two decades between 1996 to 2015, the number of articles is 29 in the first decade (1996-2005) and 53 in the second decade (2006-2015), which indicates a significant increase of more than 80%. Although it is not yet known what the number will be in the decade of 2016 to 2025, indications are positive. It is therefore clear that the number of articles for two decades have been growing substantially.

In addition, the business schools of various universities, such at the University of Pretoria's Gordon Institute of Business Science (GIBS), UNISA's School of Business Leadership (SBL), the University of Cape Town's Graduate School of Business, and North-West University Business School include CI as part of their module on strategy and have topics dedicated to CI but no specific module or research focus area.

Seminars and special lectures on CI are also presented at business schools, such as North-West University's Advanced Management Module which is an elective in the MBA program. In this regard, Professor Jonathan Calof gave a presentation on CI to students at the MBA summer school. Another example of a talk given on CI was "*Building early warning systems: leveraging Competitive Intelligence in the data science age*" presented by Scott Leeb of the Department of Information and Knowledge Management at the University of Pretoria.

Various ecosystem measures show that there has been an increase in academic activity and also demand for CI teaching at universities. CI courses are

being offered at two higher education institutions, while in this study, four universities were found to offer formal CI courses, and Master's and/or PhD studies are currently offered at seven universities [*Sewdass, Du Toit,* 2014]. In addition, as pointed out in this section, many South African universities are offering competitive intelligence within other courses. In terms of demand for CI at the graduate level, UNISA reports that in 2019, 35 applications were received for the competitive intelligence focus area in the Master's and PhD programs and in 2020, 53 applications were received.

Consultants, Training, Workshops and Conferences

To assess the situation regarding CI consulting companies, a Google search was conducted in February 2020. The search phrases and terms used were "Competitive Intelligence", "consulting", and "South Africa." The websites of the firms identified were then examined to determine whether they were "CI" consultants. Furthermore, news media and other sources were examined to determine if a particular firm was in fact a CI consulting firm.

To identify CI training workshops and conferences in South Africa, a web search was conducted in February 2020, using the search terms "South Africa" and "Competitive Intelligence" and the words "training" and "conference." The results of this search yielded the names of training businesses and conference organizers. The websites of these firms were then searched to determine whether any CI training was being offered and whether any conferences were being organized.

In the early days of CI in South Africa (1990s and the early 2000s) [*Muller,* 1999; *Viviers et al.,* 2002; *Muller, Viviers,* 2004], there were several consultancies that specialized purely in CI (consulting and training). The web search found fewer companies than were identified in the early 2000s. In fact, only two were identified that are primarily focused on competitive intelligence. Regarding these two CI consultancies, their services include consulting, training, and commissioned CI research.

Not only were fewer consultancies identified in our research, but those found were less focused on training than on consulting. However, while CI-focused consultancies are clearly fewer in number today than in the early days, several consultancies were identified that included intelligence-related activity among their service offerings. Similar to the large consultancies turning HR advice into KM advice, CI was absorbed into a wider research service offering, which is called Data Intelligence, Business Intelligence, Market Intelligence, or Big Data. Most concerning in terms of the CI ecosystem is that many of the pure CI consulting companies operating in the early days have ceased to exist.

On training, workshops, and conferences, the web search yielded zero results – in other words, there was no evidence of any training taking place or conferences being organized with CI as a theme in 2019/2020 (note that this study looks at the CI ecosystem of South Africa today). In comparison, in the early days of CI, there were several training entities providing open platform CI training courses that enabled firms to develop CI

Table 5. **Competitive Intelligence in Academe: 1995 2020**

Name of university	Name of researchers	Author/ co-authorship in articles	Number of formal CI courses	Number of M & PhD degrees awarded
North-West University	Muller, M.L. Viviers, W.	33 21	None	3 PhD 2 Master's
University of Johannesburg	Du Toit, A.S.A Strauss, A.C.	13 2	1 Undergraduate 1 Postgraduate M & PhD	4 PhD 1 Master's
University of South Africa	Nenzhelele, T.E. Sewdass, N. Du Toit, A.S.A. Maune, A. Venter, P. Tustin, D.	10 9 5 6 2 1	M & PhD Research focus area	1 PhD
Tshwane University of Technology	Magasa, L. Mphahlele, M. Awosejo, O.	2 2 1	1 Undergraduate	1 Master's
University of Pretoria	Kruger, J.P.	1	1 Undergraduate 2 Postgraduate	2 PhD
University of the Witwatersrand				2 PhD
University of Cape Town				1 PhD

Source: authors.

[7] Available at: www.informa-mea.com, accessed 8 February 2020.

[8] Available at: www.marcusevans.com, accessed 8 February 2020.

skills. These were generally taught by CI consultants, practitioners, and academics. The most prominent CI training courses and conferences in terms of number and scope of were IIR (now Informa) and Marcus Evans. These and other conference/seminar companies would typically organize a CI conference and contact trainers, consultants, and others, and ask them to present at conferences. They would also issue a call for trainers and speakers for these conferences. In addition, each would offer participants a CI seminar for an additional fee.

In the late 1990s, several of these conferences were held each year. However, a web search of current courses in CI presented by Informa[7], Marcus Evans[8], and Markex (marketing, promotions, and special events and exhibitions) yielded no results in South Africa. It should be noted, though, that seminars were identified during our search of many other countries. Such a result normally indicates that these seminar-focused firms have assessed that there is not a lot of demand for CI seminars in South Africa. This should be the focus of future research as the lack of CI conferences and workshops in South Africa runs contrary to the results in the other sections (CI practice and CI in academia).

The absence of activity could be ascribed to various factors. The lack of strong industry and professional leadership in CI has led to a diminished platform for CI in South Africa. Knowledge Management (KM) and Business Intelligence (BI) have traditionally had stronger public platforms for the promotion of products and software-related services. Furthermore, the 2008 financial crisis and the concomitant budgetary constraints on corporate funding for CI decreased CI activity. It is also true, judging by the number of jobs advertised that include CI and the wider terms like market intelligence, competitor intelligence, and marketing intelligence, that CI is being practiced ubiquitously at corporate organizations (see CI practices). The absence of training by training firms is indicative of a lack of interest on the one hand but could also be a sign that there is no longer interest in being taught the basic principles of CI. The provision of training in more advanced CI activities and analysis including Trade Show Intelligence is lacking.

Industry Associations

The methodology used to identify CI professional associations in South Africa was primarily a review of the literature on past studies, focusing on the practice of CI in South Africa and the researcher's personal experience of, on the one hand, being a member of a particular professional association and, on the other hand, of establishing and launching one of the CI professional associations in South Africa.

Regarding professional CI associations in South Africa, with the increased attention being given to the subject of CI, various professional groups were established in South Africa in the early 2000s [*Strauss, Du Toit,* 2010]. Examples of such bodies included the Society for Competitive Intelligence Professionals (SCIP) Southern Africa (SCIPSA), the South African Society of Competitive Intelligence Professionals (SAACIP), and the Knowledge Management Society of South Africa (KMSSA). The authors also found that due to membership numbers being very low in 2008, none of these CI bodies were functioning [*Strauss, Du Toit,* 2010]. SAACIP was in essence driven by a consulting company while SCIP South Africa was more an academe-/practitioner-driven body. Today only two South African members were identified in the SCIP membership database.

This lack of a professional body means that there is no list of practicing South African CI professionals available. In response to this, the Strategic Competitive Intelligence Professionals – which underwent a name change in 2015, having previously been the Society for Competitive Intelligence Professionals (SCIP) – re-launched the South African Chapter which had first been launched in the early 2000s. The chapter hosted regular seminars and helped researchers and practitioners from industry remain in touch with new developments in CI. The SCIP South African Chapter also planned and hosted the first Africa Summit in October 2014 in Pretoria with the theme *"Competitive Strategies as Practiced in Emerging African Markets"* and the second Africa Summit in 2016 with the theme *"Collaborative Intelligence for Africa's Development"* hosted by UNISA. The majority of the members of the Chapter were from SOEs such as Eskom and Transnet, and from the banking, mining, consulting, and pharmaceutical industries.

In 2013, SCIP South Africa Chapter had 20 members. The membership increased to 41 members by 2016. Several SCIP conferences and chapter meetings were held in South Africa between 2014 and 2106. By 2020, however, membership had decreased to the current two registered members. With SCIP South Africa facing membership problems and other challenges, there is no peer group or industry association for CI practitioners in South Africa. This also means that CI practitioners in the country have lost one of the avenues for gaining CI knowledge and training (through SCIP conferences, chapter meetings, and training programs).

In summary, South Africa's CI ecosystem appears to have a very limited number of CI consultancies compared to the early days, no CI conferences/workshops currently on offer, and only limited association activity. South African CI professionals therefore would have to turn to related areas or go outside the country to access any of these services.

Conclusions and Areas for Further Research

This study was aimed at extending the CI business ecosystem concept [*Calof, Brouard,* 2004; *Calof, Vibert,* 2018] to South Africa. We identified and describe the CI business ecosystem in South Africa.

CI practice: Firms and Jobs. The authors found that there is a broad cross-section of firms, both in terms of sector and size, practicing CI in South Africa. Furthermore, the current survey found a high level of CI formality now in CI practice compared to the 2014 and 2015 studies, with respondents using a wide range of primary and secondary information sources as well as analytical techniques. South African firms appear to be more advanced than firms in other parts of Africa when it comes to CI practice. However, CI activities tend to be performed within units/departments with names like market insight and business intelligence — more so, in fact, than the more traditional competitive intelligence unit. At the government level, there is evidence of some CI activities at the national, provincial, and state-owned enterprise levels, but these activities are not widespread and relatively basic in practice. In terms of jobs, supporting the findings in CI practice is evidence of several CI jobs and CI job titles throughout the main economic areas in South Africa. However, in many cases the jobs are not denoted as "competitive intelligence"; rather, competitive intelligence skills are requested or the ability to conduct competitive intelligence activities within business development, market insight, and strategic marketing units. Therefore, the study found evidence of a widening of job descriptions and deeper entrenchment of CI and CI-related activities. Using the exact phase "competitive intelligence" in the job title resulted in far fewer results. It would be valuable to gain an understanding of the CI job and skills situation in the various economic sectors in South Africa.

CI practice: Government. Intelligence as a wider concept is still largely seen as a political and military effort in government departments in South Africa. There is no emphasis upon CI at any government level but departments such as the Department of Trade, Industry and Competition (DTIC) and the Department of Agriculture, Forestry and Fisheries have CI programs and have undergone training including on Trade Show Intelligence on an ad hoc basis. There is evidence of CI within the State-Owned Enterprises. Within the DTIC, there is similar evidence of CI initiatives in the Industry and Export Associations.

CI Support: Academe. Over more than two decades there has been a significant increase in academic CI activity. The academics at South African institutions have written 88 academic articles and the increase over two decades has been substantial. The number of universities offering courses in CI has doubled since the previous studies were conducted, with several universities presenting CI and CI-related lectures as part of other courses. These activities collectively have been producing CI Master's and PhD students, CI graduates who can work at South African firms and CI knowledge that can be used to enhance South African and other countries' firm practice.

CI Support: Consultants, Training, Workshops, and Conferences. The study noted only two consultancies specializing in CI. However, the study did find several consultancies that offer CI services; these, however, are not specialized CI consultancies but rather general consultancies. There has been a significant decline in offerings of CI training, workshops, and conferences. From what used to be significant activity in each of these areas in the late 1990s and early 2000s, the web search found no such activity for 2019/2020.

CI Support Activities: CI Industry Associations. Similar to the results listed above, from what were once thriving CI industry associations (SCIPSA and SAACIP) in the late 1990s and early 2000s, the study noted only two South African SCIP members while SAACIP no longer exists.

In terms of future research, it is suggested that a CI business ecosystem study be done in other countries, perhaps other African countries. This kind of research will help increase the generalizability of the CI business ecosystem concept.

The changes reported in this study in terms of the decline in associations, conferences, workshops, and CI consultancies could also be the focus of future research. How has this impacted the overall CI business ecosystem? Has the growth in CI in academia compensated for this?

Future research should also examine the relationship between CI business ecosystem elements and organizational CI practice. For example, does strong CI academic support or CI government support lead to good firm CI practice? This paper has not looked at CI performance, but perhaps future studies should look at the impact of the CI business ecosystem upon CI performance.

Finally, the study noted that there are many other "terms" being used for competitive intelligence, with departments responsible for CI activities being called market insight or business intelligence, as well as competitive intelligence, and the jobs requiring CI skills straddling market research, insight, strategy, and other areas. Perhaps the reason for the findings relating to associations, consulting, workshops, and so on is not that there is a decline in CI activities in these areas but that associations, consultan-

cies, and so forth that have insight and intelligence in their names are part of the CI business ecosystem and are performing these activities. Expanding CI to include market intelligence and competitor intelligence was done in the jobs portion of the CI practice section of this study and it resulted in a tripling of the number of jobs identified. Future research in all areas of the CI business ecosystem research should consider adding market foresight, business intelligence, and similar terms to the CI business ecosystem. It might well be that including these terms will produce a more in-depth view and understanding of the CI business ecosystem. Expanding the terms used in future studies could produce a truer picture of the CI business ecosystem.

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Changing Priorities for Strategic Planning from National to Territorial Levels

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Abstract

This article deals with the new aspects of Competitive and Strategic Intelligence applied to territorial development. A key place is given to the epigenetics role of information in enabling institutions and people to move toward new visions and new methods of thinking. Territorial security is also examined as well as different contexts in which this intelligence is leveraged and implemented. Competitive and Strategic Intelligence at the territorial level must add to its already well-known methods and tools and consider all the ways to develop projects linked to the "commons" and thus be well received by the inhabitants. This article also emphasizes the need to explain, demonstrate, and openly present the options for territorial development in order to reach the widest possible consensus. A special note has been added to the introduction, since at the time of writing this paper COVID-19 has acted as a revealer of economic, social, and political life and the challenges the actors of Competitive and Strategic Intelligence may face in applying new approaches and a new vision for its role.

Keywords: competitive intelligence; strategic intelligence; territorial development; epigenetics; consensus; archetype; decision making; regional security

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Introduction

In the report produced by Bernard Carayon [*Carayon,* 2003], social cohesion was associated with Competitive Intelligence, highlighting the role it should play in the context of a country's economic development. Since that time, the situation has changed considerably and various crises have taken place at the geopolitical, economic, social, and climatic levels. These crises have highlighted the effects of climate change, the fragility of the economic system, an increasingly fractured society, and an international tendency to turn in on oneself. In our earlier two-volume work [*Dou et al.,* 2018], the foundations of a new Economic and Strategic Intelligence, taking into account past errors but also the changes that occur in our environment, are described in detail. Foresight, global security, and the impact of information upon the evolution of individuals and organizations are underlined.

In this context, the objective of this article is to go a little further into the analysis and to position Economic and Strategic Intelligence beyond a simple tool associated with economic growth. Then concepts, methods, and tools to enlighten this new vision are presented, adding a new dimension to Competitive and Strategic Intelligence and projecting it into a dimension more suited to helping us understand and, if possible, to anticipate the global changes currently underway.

An increasing number of terms such as "innovative nation", "smart territories", "territorial intelligence", "smart development", "sustainable development", and so on are used frequently. However, what in fact do they cover and how can we have an overall vision allowing national and local actors to harmonize actions and stimulate a constructive dynamic? This is what we are going to sketch out in order to open avenues for reflection and action. It is from a set of territories, each of which, with their specificities, their potentials, and the women and men who drive them, that the crucible foundation of the Nation[1] was formed [*Dou,* 2018c]. Although the term territory is widely used, its definition and its outline give rise to variable definitions, which are often contradictory, sometimes even opposable when one places oneself solely at the level of territorial competitiveness.

In this study we are going to defend an entirely different position, where the notion of territorial competitiveness, in the same Nation, must give way to a specific harmonization of skills to find the drivers of national competitiveness within a national synergy driven by the state.

Special Note

At the time of writing this paper, France, like many European countries, was fighting against COVID-19. The sudden appearance of this pandemic, an invisible enemy, has upset geopolitical, political, economic, and social behavior. In such a framework, Competitive and Strategic Intelligence takes on another dimension. It allows those who practice it to shed light on political errors as well as hasty and often dogmatic decision-making. It also highlights the lack of foresight, which has been repeatedly stressed by the authors of this text, or the use of this to consolidate economic and lucrative positions at the expense of citizens' health. In this context, the "commons" which were reinforced in the period of the Thirty Glorious Years (1945-1975) made it possible to secure populations by ensuring they receive both psychological and material comfort. However, the development of neo-liberalism which followed these years placed profit at the center of the concerns of political and economic actors. Thus inequalities have increased and the "commons," instead of being consolidated for the benefit of all, have been redefined so that certain people are able to take advantage of them. Think, for example, about the management of water, energy, agricultural production, industrial desertification in developed countries and health. This blindness has made us lose sight of the fact that health is a common good. The rationalization of costs and the maximization of profits have led it to become a commodity and one sees this in the decrease in hospital endowments, the scarcity of doctors in isolated areas, and the almost total dependence upon the active components of drugs.

The current pandemic is shaking up ideologies and reminding us that nobody is safe from the outbreaks of a virus and that neither the accumulated profits nor the constant progression of "soft trade" constitute a sufficient protective barrier, especially when a vaccine or medical treatments do not exist. The international shadow theater is crumbling, alliances are evolving and reshaping in a chaotic progression; what will be left at the end of this episode? Certainly changes in behavior and above all, it is to be hoped, greater security for the "commons" among which are water, energy, food, and health. Which constitutes the largest part? The authors propose water because it is directly linked to health and energy and therefore is directly linked to better security and the acceptable maintenance of living conditions.

It is in this context that a new Competitive and Strategic Intelligence must be developed to analyze the constraints, stresses, and unexpected threats that will impact communities. It must contribute to building local resilience allowing for an acceptable response to the "predicament" [*Dou et al.,* 2020] and helping create a new and ethical governance. In Competitive Intelligence, the concept of global security has been developed over time adding a holistic vi-

[1] Henri Dou, Conférence inaugurale, Colloque International L'Intelligence Compétitive des Entreprise et des Territoires, 1 — 2 Décembre 2018, Université Mouloud Mammeri , Tizi-Ouzou, Algérie.

sion to this domain. However, COVID-19 is, in some respects, reshaping our mind and our vision. For instance, when we look at the link between competitive intelligence and what is called the collapsology (from the word collapse) [*Dou et al.,* 2019], most of scholars interested in this field pointed out the need to introduce this perspective to the entire analysis [*Kyrou, Rumpala,* 2019; *Darbellay,* 2019]. But even doing so, who would have imagined the unthinkable: the pandemic and COVID-19!

From Economic Competition to Territorial Development

In most of its definitions Competitive and Strategic Intelligence is seen as a tool to improve the competitiveness of companies and to enhance their economic impact upon their own business. If the key role of information is underlined in most of these approaches, there are nevertheless some aspects of Competitive and Strategic Intelligence that are dynamic. Numerous voices point out that looking only to the economic growth may lead to a dead end. There are several points which support this view, such as:

- the gap between different classes of society is widening [*Greenwood, Hinings,* 1993; *Hanushek et al.,* 2019]
- climate change will exacerbate various stresses among the inhabitants, nations, and companies [*Staffell, Pfenninger,* 2018; *Curtis et al.,* 2017]
- new menaces, among them cyber risks, terrorism, plagues, and influence [*Duarte,* 2020]
- technological changes impact the general profiles of employment [*Franken, Wattenberg,* 2019]
- new ways of life more or less linked to ecology begin to appear [*Loiseau et al.,* 2016]
- confidence in political decision makers decreases [*LeVeck, Narang,* 2017]
- co-construction of local projects are increasingly necessary [*Froese, Mevissen,* 2020]
- a new form of competition develops between regions (even in the same state) and even city centers are opposed to the peripheries [*Hauswedell et al.,* 2019; *Hassink et al.,* 2019].

In this context, we believe that Competitive and Strategic Intelligence cannot be absent from this environment and if we want to enlarge its impact upon society, new forms of action are necessary. This is one of the reasons why France adopted the law NOTRe[2], which has given the regions the task of developing competitive regional intelligence to make all the local stakeholders in development able to use these methods and tools to encourage local development. At the same time, this law increases the power of metropolitan areas compared to the rest of the region, which, if we are not careful, will lead to an increase in territorial inequalities [*Dumont,* 2017]. We believe, however, that the development of local Competitive and Strategic Intelligence can be a catalyst for a new vision and objectives that will help reduce the differences introduced by this law. In this framework, a point which is very important is the defense of the "commons" which often are not well perceived by the local people. The inclusion of the defense of the commons and well-being into the framework of Competitive Territorial Intelligence will create new incentives and popularize Competitive and Strategic Intelligence among civilians.

Propagating Competitive Territorial Intelligence among Citizens

Currently, many people confuse territorial attractiveness and territorial specialization with competition between territories. This does not make much sense within the same country, because weakening one territory over another, concentrating all facilities in metropolises without worrying about the interstitial spaces between them may lead to a negative outcome. We are therefore going to plead for another vision, for a harmonious integration of the territories into a national whole co-constructed by all the actors.

The foundations of competition and capitalist society

In a remarkable book *L'Entraide une Autre Loi de la Jungle* (Mutual Aid, Another Law of the Jungle), Pablo Servigne and Gauthier Chapelle [*Servigne, Chapelle,* 2017] highlight the shift that has led us to consider nature as hostile and generating competition without pity, while the observation of it shows us on the contrary that mutual aid between species, cooperation, are in order while competition appears only in brief moments. The point of view highlighting competition as a goal has been described by sociologist Alain Caillé as "the axiomatic of interest" [*Caillé,* 2016]. We can also refer to the work of Jérôme Lamy [*Lamy,* 2014] on "liberal sources of biopolitics" where he defines liberalism as a "technology of power" and underlines that "The historical philosophy of Michel Foucault makes it possible to point out, behind the political practices of liberalism, the enslavement of the greatest number to market forces … Liberalism is first of all a conservatism…" [*Lamy,* 2012].

Harmony through thoughtful mutual aid

As Pablo Servigne and Gauthier Chapelle [*Servigne, Chapelle,* 2017] point out, more and more research and scientific results clearly show that competition is no longer an end in itself and that other paths of development are possible, even with the natural world.

[2] Available at: https://www.cohesion-territoires.gouv.fr/loi-portant-sur-la-nouvelle-organisation-territoriale-de-la-republique-notre, accessed 15.05.2020.

This is why "the themes of competition, the fight for life, the cumulative transmission of benefits and the elimination of the less able ... To justify a laissez faire .." are strongly contested by recent advances taking place in the field of cognitive sciences. Seen in this regard, the work [*Blanchy,* 2013] stipulates that "The myth of the separation between nature and culture is now shaken, and this has strong implications for the economic models that we can develop, allowing development in new, innovative and fruitful settings." [*Ibid.*]

This, transposed onto the field of territorial development, calls for the development of homogeneous visions embedded in the local culture, that are widely accepted and will constitute a motivation contributing largely to success. The distinction between nature and culture has led, for example, Bruno Latour [*Latour,* 1991] to indicate that "mediation must be recognized in the common production of societies and natures. Language, discourse, are another mediator between nature and society, they contribute to the production of hybrid objects that are both real, discursive and social." Thus, in the context of the choice of developments, of the visions to be appropriated by a territory, mediation, explanation, and the search for consensus will be precious allies, inseparable from success.[3] Culture must also be considered in all international collaborations, but it is also a vector of penetration and influence that should not be overlooked [*Clerc,* 2008].

The Creation of a Regional Motivation

If in mathematics two plus two equals four, it is not the same when energies accumulate. The work of a group, its creativity, is generally stronger than that of its members individually. But, for this synergy, this "alchemy" to occur, we will have to meet certain conditions, break mental archetypes and analyze in more detail the mechanisms of collaboration and leave behind the often reductive vision of current models.

Epigenetics of organizations

In the book "The economic intelligence of the future" [*Dou et al.,* 2018], we underlined the importance of these analyses, and why, to develop a vision in line with the future and the prospective, the ways of thinking must be reviewed. This leads us to better understand the evolution of organizations, not from a conventional and classical point of view, but from the point of view of their epigenetics. Henri Dou in an article entitled "From the Metabolism of Information to Economic Intelligence" [*Dou,* 2018], highlights that an organization, like a human being, can, throughout its existence, act on its "DNA junk"[4] to partially mobilize it and thus change its state. This mutation, which is partially transmissible, is found, as Joël de Rosnay [*Rosnay,* 2018] points out, within human groups and organizations. This faculty to transform, by its actions, its way of being, its way of life, and to think as part of its genetic characters, can by analogy be applied to a region, a company, and a group of companies. Thus, within these, the archetypes which prevent them from evolving, we then speak of "organizational templates" [*Greenwood, Hinings,* 1993], will fade and the group concerned will mutate and evolve. What seemed impossible will become achievable and the vision of the past will be replaced by that of the future. In the context of the influence of holistic information retrieval followed by an analysis through a critical thinking approach, a few works indicate that such practice will produce changes in the individual ability to handle information and to achieve a sort of serendipity. This direction is pointed out by [*Ackerman,*1988; *Major, Kozlowski,* 1997; Hirth, 1996], and more recently by [*Lynch, Stretesky,* 2017].

Application at regional level

One of the driving forces at an organization, in a region, is the information from which we will create "intelligence for action." It is therefore necessary to take into account and analyze how an institution is informed and how this information is metabolized. As Henri Dou [*Dou,* 2018] points out, this brings us back to the role of the "information function within an organization and, among other things, within companies. Indeed, it is from this that we will organize the creation of knowledge for action, from analyses and recommendations, applied to the strategic objectives of a company. There are, however, two ways to do this. The first, which is in our opinion the worst, is to acquire information in a completely external way without being able to intervene in its content, its coverage, and the successive iterations during which we learn to be better informed, formulate, and create a serendipity which in many cases will create a difference. The second deals with what we call the internal endogenous information function of the company, which creates a climate of curiosity and astonishment that in turn facilitates decision-making to be permanently and endogenously reinforced. Of course not all the information can be made available by the simple fact of the exploitation of various sources of information at the organization, but if a large part of it is acquired by the effort of the whole institution, we will then create the "critical memes"[5] which will encourage its transformation. In addition, fueled by

[3] For example in South Korea, the determination of the strategic technologies to be developed brought into play a "Delphi" (known as Korean Delphi) of more than 25,000 national experts. This has greatly contributed to the creation of a national consensus on the objectives to be achieved.

[4] Any DNA fragment present between DNA coding sequences. This DNA may or may not encode regulatory sequences: http://dictionnaire.sensagent.leparisien.fr/Junk-ADN/fr-fr/, accessed 18.02.2020.

[5] The "méme" is a cultural equivalent of the gene. "A unit of information contained in a brain and exchangeable within a society" [*Dawkins,* 1976].

a collective effort to access information and analysis, the archetypes acquired during the past existence of the company or of the human group concerned may be changed, the "non-human"[6] world, that is to say the interface of the company with the outside world, will become more understandable and will generate new behaviors.[7]

Towards a New Territorial Intelligence

This analysis leads to the need to revisit Territorial Intelligence at different levels. These will concern, first, common goods (commons), among other things in the sense of preserving the environment [*Baaziz et al.,* 2017, *Dou, Leveillé,* 2015]. The concept of the "commons" is fundamental if we want to achieve sustainable and harmonious territorial development. It is only necessary to recall the quotation from Peter Linebaugh [*Linebaugh,* 2010] "the enclosure movement in England is one of these concrete universals, like the triangular slave market, witches brought to the stake, Irish famine, or the massacre of the Indian nations, which make it possible to define the crime of modernism, each time limited in time and space, but always going beyond the specific and likely to come back to the fore" and Elinor Olstrom's research [*Olstrom,* 1990, 2012] whose work on the management of "commons" won her the Nobel Prize in Economics in 2009 [*Le Crosnier,* 2012].

Secondly, there is the need to not use the name of specialization or intelligence (in the sense of "smart development") in intra-regional competition, which does not allow in most cases for creating a positive synergy between the actors. Similarly, it is necessary to avoid (or at least limit) the concentrations of wealth on specific poles in a region, which is to the detriment of the rest of the region. Indeed, the new economy, if it creates wealth, has the effect of concentrating it on the one hand and on the other, limiting its diffusion to the periphery. We can consult on this subject in the work of Laurent Davezies and Thierry Pech [*Davezies, Pech,* 2014]. We thus find in the concepts of cooperation and mutual aid, a positive complementarity and a mutation catalyst that has as a starting point the individualization of the people involved in the group in the sense of Simondon [*Neves,* 2011; *Chabot,* 2013], a true philosopher of information which in his informational ontology, presents a radically new materialism that stands to change contemporary debates surrounding issues related to information, communication, and technology [*Iliadis,* 2013].

The role of Competitive and Strategic Intelligence

Economic Intelligence is rightly seen as a dynamic element for positive change. The positioning of regional strengths and weaknesses in a national or international environment plays a major role, but for this it is necessary to acquire the necessary information, share it, and from this, develop a clear vision of regional development. What can we do (implied together!)? This question challenges both ideas and pressures of all kinds, psychological and material, from the regional past. If common history cements women and men, it should not be an impediment to development by freezing positions. It is in this sense that acquiring new forms of thought, having a clear vision of geopolitical developments, and developing a "endogenous information" function will quickly lead to the monopolization of "dormant energies" [*Dou et al.,* 2018]. We thus create by analogy with the monopolization of certain genes in the sense of the epigenetics of human beings, new behaviors that are partially transmissible and reversible [*Berger et al.,* 2009]. This reversibility requires the continuous application of Competitive and Strategic Intelligence. It is clear that all the methods and tools of Competitive and Strategic Intelligence are still usable [*Revel,* 2015], but it is necessary to broaden the horizon of the latter by using foresight, collective intelligence, and strategy [*Dou et al.,* 2018] as well as the development of regional spheres of influence driving the exports [*D'Aveni,* 2012]. In the same way, various authors such as Madureira and al. [*Madureira et al.* 2019] suggest that

> "The CI model, however, has not evolved to address evolving intelligence needs, highlighting an opportunity for further research on how to fit for purpose the CI process itself …" and suggest that the "Design Thinking mindset and process has potential for the application to the CI model, improving efficiency both in the overall process, at each stage and in CI." This clearly seconds the vision for a holistic effective change to the Competitive Intelligence approach. The various steps of Design Thinking [*Micheli et al.,* 2019] are similar to the De Bono [*Göçmen, Coşkun,* 2019] solving problem system.

Create a national dynamic

We have so far only considered the region, but the nation, the sum of all regions and the different communities that make them up, can facilitate this new approach. This can be achieved by setting up a Competitive and Strategic Intelligence policy at the national level without repeating the mistakes of the past generally committed locally or by third-party examples. This policy must obviously be based on technical elements and supports, on compendiums and repositories [*Revel,* 2015], but if it is limited only to this "material" aspect of things, we will quickly see its failure. In the context of this national policy, the

[6] The "non-human" world is taken here in the sense of Simondon (opus cited), in particular with the technological environment which surrounds us and is constantly evolving.

[7] Available at: https://www.franceculture.fr/emissions/les-nouveaux-chemins-de-la-connaissance/gilbert-simondon-14-du-mode-d-existence-d-un, accessed 15.03.2020.

common good, shared between the actors of the territory and developed by a dynamic economy must be constantly reinforced. In this sense, cooperative actions, individual and collective contributions, and the creativity of individuals [*Verlaeten,* 2010] must not be considered obstacles, but constructive values. Thus, competition must be replaced by cooperation, directionality often exercised in a "top down" manner must in many cases be replaced by a "bottom up" approach, the difficulty resting upon the organization of new participatory methods. Finally, the development of a region must primarily have as its objective the growth of the national economy, but also, and this is often forgotten, the increase in the well-being of the individuals that make it up.

Territorial Security

Territorial security today is an important element for residents and businesses. There are many aspects, from physical security to abusive approaches (telephone marketing or solicitations via the Internet) and the cybersecurity of companies. It is therefore important, within the framework of Competitive and Strategic Intelligence, that these aspects are considered in order to give regional decision-makers the necessary information and also to explain good behaviors to avoid being victims of these embezzlement schemes.

Physical security

The state, within the framework of the national plan of Economic Intelligence, set up organizations intended for the representatives of the police forces, mainly those of the "gendarmerie." The gendarmes, who are in contact with the local population and who crisscross the territory, are able both to inform and also collect useful information to ensure general protection. In the context of business protection, at the territorial level, more than 80% of SMEs and very small businesses are located in the area of gendarmerie's competence in matters of public security.[8] Based on this territorial network, the gendarmerie has economic security and business protection referents (SECOPE) in each region, in each department, and in each of the specialized gendarmerie groups. The national gendarmerie has nearly 200 economic intelligence advisers. All of these protective actions are part of the economic security plan[9] developed in France at the national and regional level. This service (Strategic Information and Economic Security (SISSE)) manages a network of delegates responsible for coordinating the implementation of the economic security policy.

Information and good behavior

The Cybermalveillance.gouv.fr service[10] is responsible for helping businesses, communities, and individuals strengthen their own cybersecurity by informing them about current digital threats and explaining the correct behavior to follow. For example, the website of this service informs the public about threats that may appear during updates to computer operating systems, how to protect mobile devices (smart phones, tablets), how to manage passwords, security on social networks, how to learn to separate your domestic and professional uses, and why and how to manage your computer backups properly. This is just an example of general public information. The following figure shows the interactive characteristics of the cyber malware information site.

Economic interference

In this context, the DGSI (Directorate General of Internal Security) provides companies with "flashes" in the form of electronic bulletins.[11] These "flashes" indicate actions of economic interference of which French companies are regularly victims. Designed to illustrate the diversity of situations that companies are likely to face, it is at your disposal to assist you in propogating an internal security culture.

Practical Methods of Implementation

Implementing such a policy is not easy. At the regional level, a concentration of actors is essential in order to analyze the existing potential, whatever its nature (the choices of areas to be developed will be made after). This done, it will be necessary to facilitate the decision and analysis by setting up an efficient information function, localized or networked. The goal is ultimately to allow the best decision-making, but also a clear explanation of it [*Latour,* 1991] so that a consensus is created. Once the decision has been made, the methods of achieving it will have to be analyzed critically in order to see to what extent regional forces are sufficient to achieve the objective, if possible, a motivation will be created to facilitate action. If the necessary potential to achieve the objectives is not available locally,[12] it will be necessary to see if these skills are transferable or exploitable in a delocalized way. If this is impossible, more realistic objectives

[8] Available at: https://www.gendarmerie.interieur.gouv.fr/Nos-conseils2/Pour-les-professionnels/Presentation-de-la-chaine-des-referents-Securite-economique-et-protection-des-entreprises-SECOPE, accessed 15.05.2020.

[9] Available at: https://sisse.entreprises.gouv.fr/fr, accessed 04.05.2020.

[10] Available at: https://www.cybermalveillance.gouv.fr/, accessed 14.01.2020.

[11] Available at: https://www.globalsecurity.org/intell/world/france/dgsi.htm, accessed 16.04.2020.

[12] Be careful, because in many cases we will see a certain number of people, even companies or institutions claiming to be experts in all fields appearing under the concept of multidisciplinarity. As Alain Caillé [Caillé, 2018] points out, "The false ideal of multidisciplinarity is the perfect complement to the academic triumph of hyperspecialization and disciplinary fragmentation." It is therefore necessary to use recognized experts to validate the choices so as not to leave a certain number of makers and "illusionists" to grab the attention of decision-makers.

will have to be selected. But this is far from being enough, we will have to somehow master the process of achieving objectives. For this, a contract is the best way to do it.

Contractualizing actions, continuously monitoring them, and modifying part of the objective if necessary are the best way to manage regional objectives dynamically. This means that the monitoring of operations should not be limited to the recording of interim reports, but to a real analysis of the latter and, if necessary, to reduce or stop the funds allocated in the worst cases. Managing projects in a democracy is a difficult task, but the good governance of it is the best critical factor of success [*Leese,* 2017].

Here we touch upon a sensitive point concerning innovation. An innovation is the transformation of ideals and skills often acquired thanks to state funding into profitable products. This regional implementation also means that actors that have different objectives, for example associations, academics, and industrialists, will be brought to work together. The management of such groups is a critical task that must be mastered, the common denominator being action to improve the public good. For example, within universities, it is necessary to develop the RSR (Social Responsibility for Research) [*Dou*, 2010]. For industrialists, they must not consider that discussion with academics a waste of time. Politicians must put into place the events and structures that will encourage contact between various parties, but they must also understand the fundamental role played by Competitive and Strategic Intelligence to federate the actors and create a regional dynamic.

Regional development brings into play both the practices of institutions and people based on archetypes acquired throughout their histories. This calls for collective action and responsibility [*Nonaka et al.,* 2000]. If, as Simondon points out [*Neves,* 2011], the individual is in permanent tension because of its relationship with change, it will be necessary to reinforce the collective action using different methods than the conventional ones applied today, which means one must explain, demonstrate, and try to achieve a wide consensus.

The development of biomedical research is interesting especially amid COVID-19. Let us quickly return to the concept of innovation. Innovation leads, thanks to state funding, to the creation of know-how and knowledge in public research laboratories. This knowledge will then be used to help create marketable products. This process is generally carried out through start-ups, which, when they are successful, are bought by large pharmaceutical companies, often foreign (this is the actual French model). However, since the creation of knowledge is carried out thanks to our taxes, since it is the state that finances such

Figure 1. **Screen capture of one of the domains covered by the cyberbullying site**

Translation: I am a professional, I would like to document myself on good practices relating to all threats. Choice: to all the threats, to my data, to emails, to computers, to websites, to tablets, to phones.

Source: https://www.cybermalveillance.gouv.fr/bonnes-pratiques, accessed: 14.01.2020.

projects, we must ask to ourselves a fundamental question: is public research (at least its results) a public good? Does it fall within what is commonly known as the commons [*Dou et al.,* 2020]? The answer to this question is essential because if it is affirmative, it must lead to a different marketing model [*Holloway, Herder,* 2019]. This is a hot topic if we consider the discovery and production of a vaccine against COVID-19.

Examples of Implementation

Increasingly, the action of civil society in collaboration with or without regional political bodies allows for the development of innovative achievements or structures. Success in projects comes mainly from the feasibility of the latter according to local capacities and knowledge, but also from the broad consensus which supports them. The three following examples will illustrate this point.

Luc sur Aude's citizen solar park

Luc sur Aude is a small French town located in the southwest of France, where an event took place within the framework of territorial development that is particularly meaningful. For almost 10 years, a photovoltaic park project has been under study in the scrubland north of Luc-sur-Aude. Various promoters presented themselves without their projects succeeding. If the operation is profitable for industrialists, why should it not be profitable for a community? From this observation was born the citizen solar park project, which is energetically sustainable, humanly feasible, and economically profitable.[13] Thus, in 2018, "In the Aude, a photovoltaic power plant financed and managed by the inhabitants was developed.

[13] Available at: https://www.luc-sur-aude.fr/projets/parc-photovoltaique/, accessed 12.02.2020.

1,2,3 Soleil is the first French citizen solar park built thanks to crowdfunding: 286 individuals, residents of the village of Luc-sur-Aude or its surroundings, have invested in this power station which will produce 320,000 kilowatt hours per year, i.e. the consumption (excluding heating) of the Luçois" [*Rollot,* 2018]. This is how citizens of a rural village in the south of France took their destiny and energy autonomy in hand.

> "For several months in 2018, the Luc-sur-Aude photovoltaic power station, near Limoux, has been producing electricity with the financial participation of its inhabitants who have become shareholders in the installation. The project had the honor of the visit of the president of the region, who came to visit the first participative photovoltaic park of municipal inspiration in France. We wanted a project sized to cover the electricity needs of our town while keeping the added value thanks to citizen shareholding, explains the mayor of the town, who will have taken eight years to make this dream come true."

As the BFM Business station pointed out during a TV broadcast on June 12, 2018[14]: the main lessons to be learned from the success of this project corroborate all the aspects related to territorial development presented above. The shared vision, mutual aid, continuity in action, consensus, the participation of local political bodies, and the financial participation of local actors cemented the consensus. This success also underlines the fact that technical solutions exist and that many of them can be implemented within the framework of shared local will.

The Territorial Poles of Economic Development (PTDE)

Like the competitiveness clusters developed in France since 2005, various reflections have led to the emergence of the concept of PTDE (Territorial Poles for Economic Development). A definition was developed by the ESS laboratory,[15] "A territorial pole of economic development (PTDE) is a grouping, on a given territory, of initiatives, companies, and networks of the social and solidarity economy associated with SME managers, local authorities, research centers, and training organizations, which implements a common and continuous strategy of cooperation and mutualization for the service of innovative economic projects of sustainable local development" [*Matray, Poisat,* 2014]. Indeed, territorial development projects are based in part on creating innovative achievements by:

- the capacity of actors to create and develop through deliberation in a public space [*Habermas,* 1978]
- collective intelligence [*Heurgon,* 2006]
- mobilizing all stakeholders, including the university [*Goujon et al.,* 2011, *Dou,* 2016]
- the training organizations

We can thus see that beyond all kinds of blueprints, often virtual directives, we can hardly achieve anything without the motivation of the actors, a well-reasoned explanation of the projects, and the active participation of civil society.

The experience of the Var region

The Provence Alpes Côte d›Azur region includes several departments including Var. It is wedged between Marseille metropolis and Nice Sophia Antipolis. In this configuration, the Var must find a new identity that will allow it to implement its own development between two entities (Marseille and Nice) in which is concentrated a large part of all the resources of the Sud Provence Alpes Côte d›Azur region. Under these conditions, two facts emerged: a rise in the power of civil society and a division of the department into territories having a social, cultural, economic, and geographic identity. The geographic space is bounded by a 20-minute drive. The economic, cultural, and social aspects have been carefully examined so that the territories are homogeneous. Eight territories were thus created after surveys, studies, INSEE data, and consultations of the concerned municipalities. This is how the 153 Mayors of the Var's municipalities have joined this approach, all political positions combined. Unlike the Alpes Maritimes and Bouches du Rhône, which have a metropolitan approach, Var is part of a concerted territorial approach. The Var territories — so-called Strong Points (PFs) — are as follows:

- Aire Dracénoise PF: urban economic and nature center
- Coeur du Var PF: nature and development
- Fayence PF: hilltop villages and green tourism
- Gulf of Saint-Tropez PF: international tourism
- Haut-Var Verdon PF: nature, escape, and competitiveness
- Provence Méditerranée PF: metropolis, competitiveness, and sea
- Provence Verte PF: historical heritage and development
- Var Esterel PF: economic dynamism and living heritage

It was upon the basis of the dynamics of these territories that the concept of a contractual project over a period of three years was born. The objective was to develop a project for each territory, three types of which may be involved:

- Local actions (services, equipment, and activities),

[14] Available at: https://bfmbusiness.bfmtv.com/entreprise/comment-ce-village-occitan-a-finance-sa-propre-centrale-solaire-1468552.html (accessed 07.04.2020)

[15] Available at: www.lelabo-ess.org (accessed 19.05.2020)

- Structuring actions (networking and interconnection with neighboring territories), for example, broadband, physical mobility, etc.
- Flagship projects to enhance the reputation, image, enhancement, and attractiveness of the territory.

In each case, it is necessary to consult the public and private sectors whenever possible and to make extensive use of innovations from civil society based on calls for projects. This includes actions aimed at developing tourism, new concepts for activity zones, open work spaces, the creation of labels for products from the region (it is not just wine that is concerned), local gastronomy, assistance to the elderly, and so on. We can also note, in the same vein, the creation of a local television channel: Var Azur.

There is thus a double entry at the territorial level: projects from elected politicians taking into account major facilities or structuring projects, but also an entry from civil society through the intermediary of the calls for projects. The goal is both efficiency and consensus. An innovative aspect of this development system is the contract. Each of the projects is linked by a three-year contract to the entity funding the project (generally the Departmental or Regional Council). This contractualization makes it possible to monitor the project both in terms of timing or implementation as well as in financial terms. The project contract then becomes an effective engine of development. We are thus moving towards a culture of results. To further increase the cohesion and synergy, the Territorial Development Houses (MDT) were developed in which civil society and the human dimension are directly concerned. The MDTs will also play the role of a territorial observatory: local project files are evaluated there, the link with the population will be strengthened by various services, and the local economic fabric will be able to be energized both by contacts and communication.

In parallel with this territorial development, civil society and more particularly companies organize themselves independently of political power or of institutions such as Chambers of Commerce and Industry. This is how the "Var Business Parliament"[16] was launched by personal initiatives. It was created so that major decisions are not based solely on elected politicians so that the voice of civil society is taken into account.

The Var Business Parliament, an original initiative in France, has become a promoter of ideas, projects, and innovation. It operates on the basis of commissions and we can cite an example from the blog of the Var Business Parliament:

> "Nearly 400 actors from the Var business world participated in the plenary session of the Var Business Parliament. On the program, the examination of 8 motions relating to the maritime economy, the circular economy, and the advisability of a territorial branding were proposed.

It is a great demonstration of the collective intelligence to which we are entitled. In turn, the committee leaders, after having showcased the fruit of the work carried out over several months, presented concrete motions, based on field reflections for a vote. For a more in-depth description of the functioning and role of this parliament, you can consult the blog of Patrick Heintz.[17] A quote from the author of this blog sums up the question well:

> "There are in the almost 60,000 companies that make up the economic fabric of our territory, treasures of experience, imagination, know-how that can contribute to significantly improving our economic environment by working more together on common strategies, by cooperating and mutualizing better, by exchanging more on practices, methods, by sharing know-how, services, certain tools, means, networks. The Var Business Parliament can be the place where this collective awareness occurs, where these new relationships are formed and where the economic world makes its voice heard."

Conclusion

Territorial development requires, in addition to the methods and tools of Competitive and Strategic Intelligence, a strong mobilization of local actors because the results obtained at the territorial level are more easily perceived by the whole population. As a result, the time constants necessary for carrying out the projects will be shorter, so any delay or any long-term project must be justified. In addition, at the territorial level, the search for synergy between the actors, the complementarity of skills, and consensus must be sought. As pointed out by Yun and al. [*Yun and al.,* 2020] "The competitive intelligence experts and scholars have published a large number of theoretical knowledge in methodology.… The mastery of any knowledge could not be completed in one time. It needs to go through many cycles of 'reading, seeing, listening and thinking.' We all need to verify our knowledge in specific problems to truly understand it, thus our understanding will go further." The objective is to create a change of mentality, to rely upon studies involving the psychology of stakeholders to engage them in a renewal of mental archetypes which often impede the situation and block development. This calls for territorial engineering leaving more room for human sciences compared to strictly technological considerations. For this, the history and local culture or cultures must be analyzed and often used as leverage to monopolize energies, which is the case under various conditions such as NATO operations [*Yankov,* 2019] as well as in economic development [*Kafka et al.,* 2020], tourism [*Alazaizeh et al.,* 2019], or even organizations [*Hashemi,* 2016]. Finally, civil society is directly concerned with territorial development and we must set up the participative modali-

[16] Available at: https://www.var.cci.fr/content/le-parlement-varois-des-entreprises-les-commissions (accessed 11.03.2020)

[17] Available at: http://patrick-heintz.over-blog.com/ (accessed 09.02.2020)

ties of this when defining a vision and the projects that result from them. Furthermore, this must be the case throughout their realization and analysis and the judgment of the obtained results. This is one of the most important conditions for success, because in the 21st century in France, we can no longer be content with an election every five years (depending on the country) to validate a policy or correct its mistakes. The world evolves more quickly than the electoral cycle, it is necessary to take it into account and not to fear the questioning of certain orientations. This is seconded by Strobl and al, who suggest "political electoral cycles [*Strobl et al.,* 2019] are used because voters heavily discount the past and give greater weight to recent political accomplishments. Voters may value recent events more because they are more informative and relevant for predicting the future and because it is easier to access and retrieve current information from memory. This cognitive bias leads voters to place more weight on the period right before an election." However, when a dramatic event such as COVID-19 occurs, this event acts as a stress test for democracies and pinpoint the above political behavior. The result is then an increase in the lack of confidence in elected officials and the need for better use of democratic instruments.

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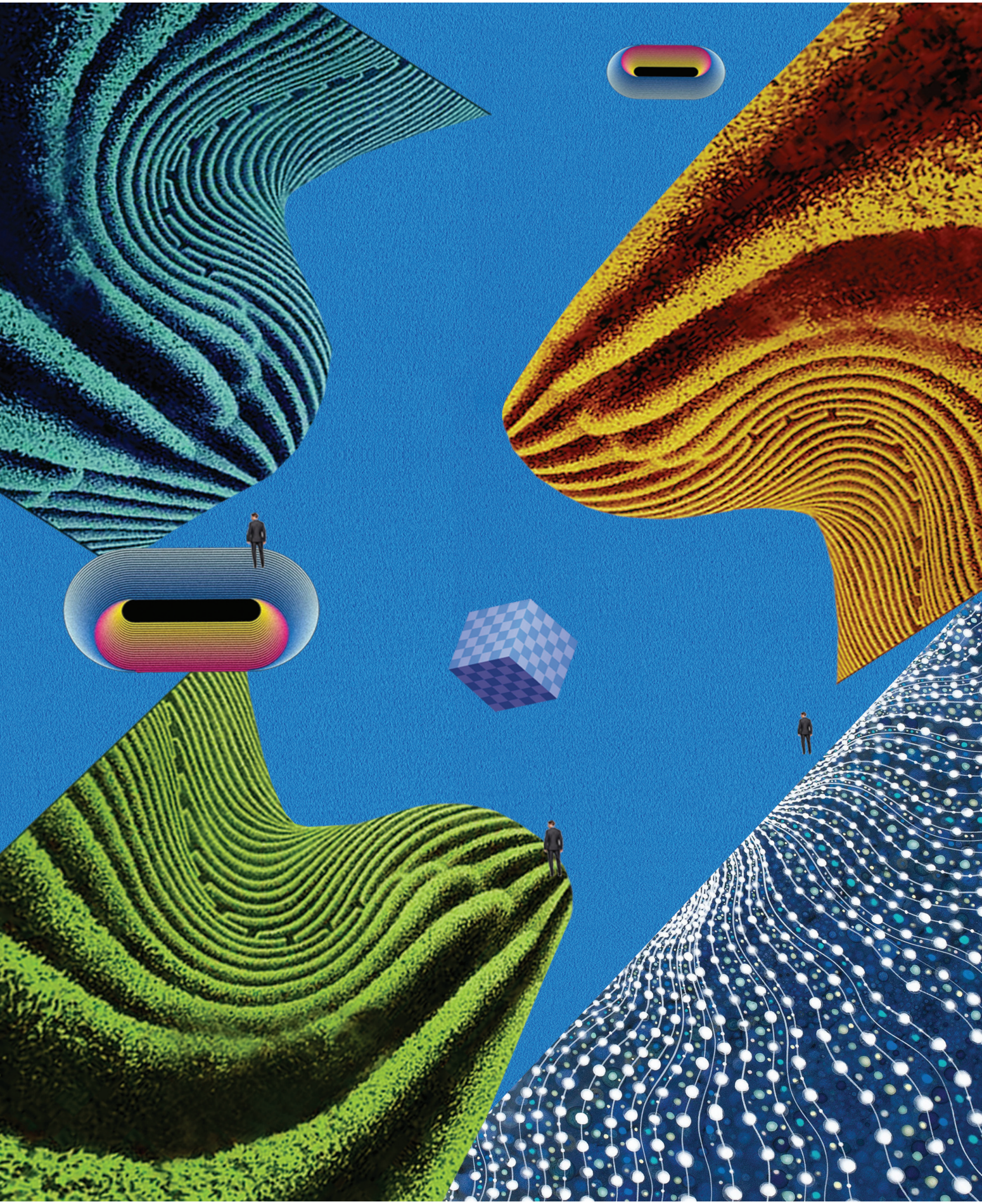
EDUCATION



Strategic Intelligence Teaching to Leverage Professional Success

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Abstract

This research investigates whether undergraduate students believe that Competitive Intelligence (CI) teaching leads to an increase in their chances of professional success, regardless of whether they want a career in CI or not. It is an exploratory study, with an initial section on bibliographic research about CI teaching, followed by assessment of the perceptions of a class of six undergraduate students in a semester-long CI course. The data analyzed were: 1) teacher assessment; 2) students' self-assessment of the Degree of Learning (DL) in certain attributes of competence (i.e. pre-established knowledge, skills, and attitudes); 3) self-assessment of the Degree of importance (DI) for the same attributes in achieving the students' professional success (the reference for this part of the self-assessment was the individual career strategy, created by each student during the course). Based on the DL results and the teacher's assessment, it was found that CI instruction was positive for all students. In addition, the self-assessment results indicated high DL and DI medians for almost all attributes, suggesting broad mastery of various attributes of competence considered important by students for their own professional success (despite the limitations in terms of statistical confirmation). The present work is original and relevant as it provides initial evidence that CI teaching can increase the chances of professional success for undergraduate students, even for those who do not wish to act as CI professionals. Furthermore, it is expected that the same benefits achieved by Brazilian students will also be available to CI students around the world since the appropriate adaptations were made, which have significant practical and social implications related to their employability and success.

Keywords:
competitive intelligence; professional success; teaching; competence; knowledge; skills; attitudes; career strategy; self-assessment

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Around the world, the job market is becoming increasingly competitive. Good job opportunities require more and more skills, while the number of qualified people continually grows. In order to overcome this situation, professionals combine specialized training for specific contexts with the development of broader competences aiming at different situations — such as informational competence, related to obtaining and analyzing information [*Horton,* 2007; *Julien et al.,* 2011], which is valued by the labor market due to the strong link between organizational performance and the effective use of information.

This competence is directly related to the practice of Competitive Intelligence (CI) [*Ottonicar et al.,* 2018], whose distinctive feature is the production of high value-added information to support decision making [*Fuld,* 1995]. Due to this connection, it can be claimed that CI teaching can be a way to develop competences aimed at leading individuals to professional success. Since it is based on informational competence (and, therefore, on a more general idea of employability), this argument indicates the benefit that CI teaching can bring to everyone regardless of their areas of expertise or even their personal dreams of professional success.

On the other hand, there will be those for whom CI teaching will represent more than a general gain in employability. For CI professionals (or those aspiring to become them), CI teaching boosts their "right employability" — the one that represents a pathway towards the fulfillment of their specific professional desires and goals. This position is corroborated by alumni from institutions of excellence in CI teaching (such as those from the Academy of Competitive Intelligence (ACI)[1]. For them, the competences developed in the CI course directly support their CI careers (and, of course, their expectations and dreams of professional success).

When we are talking about a CI discipline for undergraduate students, not all students are convinced of the merit of the pursuit of a CI career (in fact, most of them are more interested in increasing their employability by developing their information competence or even by adding an interesting new skill to their curriculum). For these, therefore, there is no direct connection between CI learning and the achievement of their own professional goals, as in the case of ACI alumni.

To achieve this kind of success, undergraduate students must master competences that are connected with their own expectations of success. From this observation, one question arises: do students who enroll in a university CI course, but do not wish to pursue a career in this area, achieve only a general gain in employability or do they actually achieve "right employability"? Or, in other words: does a CI discipline have the power to leverage the true dreams of professional success for all of its students or only those who will pursue a career in CI?

To investigate this challenge, the present work evaluated whether a CI undergraduate discipline could develop competence attributes (knowledge, abilities, and skills) indicated by the students as strongly connected with their professional success expectations. Next, we will present the architecture of the adopted CI teaching process, its implementation, and results whose analysis points to the veracity of the relationship between CI teaching and the increase in the chances for professional success of undergraduate students, in the opinion of the students themselves.

Competitive Intelligence Teaching

Attracting good professionals to the practice of CI is not a difficult task as this represents an exciting career and with many opportunities, especially for information professionals [*Bexon et al.,* 2002]. On the other hand, it is still a challenge to find suitable training in the area, especially in some regions of the globe.

Due to certain cultural, academic-disciplinary barriers, CI university education is still limited. For this reason, and because of the strategic importance of CI, even governments end up becoming involved in CI dissemination and education [*Runtuwene et al.,* 2014; *Calof,* 2016]. However, class associations and some educational companies have been responsible for most of the challenge of training professionals in this area.

With regard to associations, SCIP (Strategic & Competitive Intelligence Professionals)[2] has been playing an essential role in training CI professionals, either through the courses it has led, the congresses and seminars it has promoted, or through publications about this subject it has disseminated [*Miller,* 2000]. Related to this point, SCIP has published many articles, editorials or columns (such as [*Calof,* 1999; *Blenkhorn, Fleisher,* 2003; *Gilad,* 2003; *Hulnick,* 2003; *Kalb,* 2003; *Gutowski,* 2007; *McGonagle,* 2007; *Glitman,* 2008]) through its main publication (Competitive Intelligence Magazine) aimed at CI teaching. In them, a wide range of subjects were dealt with, including the curriculum, teaching methods and techniques, and the influence of students' profiles upon course design, among others.

Some specialized companies have also made an essential contribution to CI training. Probably the most well-known example is that of the Academy of Competitive Intelligence, which for more than thirty years has been providing specialized CI education to over 10,000 professionals and high-level

[1] Available at: https://academyci.com/alumni/, accessed 19.06.2020.

[2] Available at: https://www.scip.org/, accessed 19.06.2020.

decision makers from 71 countries around the world. Currently, they offer one of the most coveted professional CI certifications in the world in addition to in-house training, distance training, and individual development for executives.

Concerning universities, even considering the possibility of undergraduate or postgraduate courses entirely focused on CI, a good part of the CI teaching will occur through isolated disciplines offered to students with very different demands and profiles from those who seek the SCIP or ACI certifications. To begin with, not all students have a clear intention of pursuing a CI career. Several of them want to either enhance their curriculum or develop their informational competence to increase their employability. Furthermore, they are often very young and have no professional experience (as reported by [*Blenkhorn, Fleisher,* 2003]) and are unfamiliar with business terminology [*Gutowski,* 2007].

In order to adapt to the profile and demands of its public, university CI teaching has been applying its own solutions, some of which have been reported in the literature. Blenkhorn and Fleisher [*Blenkhorn, Fleisher,* 2003] highlight how much the use of projects as a tool for CI teaching are appreciated by undergraduates as it allows them to compare their knowledge with the real world and encourage them to overcome their competence gaps. Combining classes with hands-on activities is recommended in many papers [*Miller,* 1994; *Bexon et al.,* 2002; *Gilad,* 2003; *Fleisher,* 2004; *Zhou, Wang,* 2013; *Lemmer,* 2015]. It was even possible to find a development initiative of a computational platform for undergraduate students aimed at CI teaching [*Suyin et al.,* 2010].

Another constant in this literature is the development of competences. This subject is present in various papers [*Calof,* 1999; *Kalb,* 2003; *Strauss, Du Toit,* 2010; *Zhou, Wang,* 2013] and it represents the educators' conviction that effective teaching should impact the CI competences and its attributes (knowledge, skills, and attitudes). However, the same literature is restricted with respect to empirical studies that assess this impact. Such is the first contribution of this paper.

The other contribution is related to the absence of studies on the real effectiveness of university CI courses on students' professional success. The literature on CI teaching at universities has focused almost exclusively on a restricted (and probably minority) audience: the students dedicated to having a career as a CI professional after college. But what about the others? Are our CI disciplines bringing them any closer to their idea of professional success? Such answers were not available in the literature.

Development

This research was conducted with six students pursuing a Bachelor's degree in Library and Information Science from the University of Sao Paulo (Ribeirao Preto campus) enrolled in an elective course lasting 16 weeks, three hours per week in class and two hours per week (on average) of fieldwork outside the university. This course is focused exclusively on CI and has been offered every year since 2011. The six students correspond to the total number of students in the class, none of whom had previous training in CI.

Throughout the semester, students had weekly lectures, studied books and papers from international literature in the field [*Fuld,* 1995; *Prescott, Miller,* 2002; *Sawka,* 2002; *Bensoussan, Fleisher,* 2003; *Tyson,* 2006; *Porter,* 2008], as well as the content produced by the teacher for the classes. In parallel with the theoretical activities, the students undertook an individual CI project comprising several practical activities aimed at developing knowledge, skills, and attitudes related to CI performance. Each student selected and obtained permission to perform the project at a real organization (usually the one in which the student was doing his/her internship or was employed). Students, who could not identify an organization, were assigned one by the teacher.

Developing an individual project proposal was based on the Active Learning methodology that, in its various modalities, seeks to introduce flexibility and adaptability in different teaching contexts (including undergraduate courses) supporting innovation and promoting student-centered educational practices [*Gleason et al.,* 2011; *Lantis et al.,* 2019]. This theoretical framework was very important for the project design because it added consistency and completeness to the way in which it was planned, managed, and executed. Due to this theory, as well as the experience accumulated with the different CI classes over the last nine years, the role of the teacher and students in supporting the achievement of individual projects has been defined and refined.

The table below shows the two individual CI project macro activities carried out throughout the course with the teacher's feedback.

In parallel with the theoretical and practical activities already described, each student developed (under the teacher's supervision) their individual career strategy (i.e. a path to be taken to realize his or her dream of professional success).

On average, 30 minutes per week were devoted to discussing topics related to the construction of a career strategy: career purpose (the essence of professional success for each one); strengths and weaknesses (personal inventory of the most important internal factors to achieve desired success); career opportunities and threats (list of the most favorable and unfavorable external contingencies related to desired success); and the career strategy itself (textual or schematic representation — such as a mind map, for example — of the concrete path to achieve the desired success). In addition, a closed Facebook group was created to continue classroom discussions and allow students to exchange information and gain insights.

Table 1. **CI project macro-activities**

Macro-activities	Templates and Educational Support Tools
Diagnostic of the organization selected by the student	Form filling (divided into two parts) concerning size, billing, type of economic activity, organization charts, number of employees by functional area, main products/services, main suppliers, market segmentation and participation by segment, mission, vision, values and strategic goals. A Pecha Kucha style presentation (https://www.pechakucha.com/) was held to disseminate the results among the students.
Analysis of the external environment of the organization selected by the student	This macro activity covered the study of the macro environment and the competitive environment, using Porter's Five Forces and the STEEP Analysis (the latter according to the approach described in [Bensoussan, Fleisher, 2003]. Several actions of this macro activity (especially information analysis) were partially carried out in the classroom, with the direct support of the teacher. Another Pecha Kucha-style presentation was held at the end of this stage.

Source: author.

Teacher evaluation took place throughout the semester. From the macro-activities, task blocks were formed that were performed by the students weekly. The results of these tasks were consolidated into reports/deliverables (see Table 2), which were reviewed and returned to students for learning and corrections (most of the deliverables were inputs to subsequent tasks and therefore their correction was usually required). Thus, everyone could monitor their own progress and make adjustments to their study process and CI project if necessary.

Part of the assessment was accomplished at the end of the course, when students performed self-assessment using a questionnaire based on the attributes of competence (knowledge, skills, and attitudes). Self-assessment is widely recognized as a relevant approach to student learning measurement [*Dochy et al.,* 1999; *González de Sande, Godino-Llorente,* 2014] and has been reported as a valuable option even in the context of CI teaching [*Keiser,* 2016].

The initial goal of self-assessment was to establish the Degree of Learning (DL) of each attribute of the competence indicated. To this end, it was emphasized that students should disregard their past mastery of attributes and focus their assessment exclusively on advancing those promoted by the course. In addition, as the quality of the assessment depended upon the students' understanding of the meaning of each attribute, the process of explaining the questionnaire also encompassed this prior clarification.

Assessing CI learning through a list of attributes of competence entails the recognition that one of the aims of teaching is to develop the competences necessary for successful CI practice. From this conception comes an essential advantage, that is, to keep the focus of the educational process on the students' competences. However, other difficulties appear, such as choosing how competences will be developed and evaluated, or even choosing which attributes of competence are to be considered in the process.

Regarding the development and evaluation of the competences, the approach adopted in the course has already been described: in the case of development, the union between theory and practice mediated by Active Learning as well as assessment, correction, and feedback throughout the semester (Table 2) plus self-assessment at the end of the course. Especially in the case of evaluation, using both strategies contributes to increasing the reliability of the conclusions. Moreover, it should be remembered that this topic is controversial and there is no evaluative strategy that is considered definitive, especially those aimed at assessing the attributes of competence [*Rychen, Ferrer,* 2004].

Concerning the choice of attributes, it was based on the main activities of the intelligence cycle and the most recurrent competences in the literature [*Calof,* 1999; *Kalb,* 2003; *Strauss, Du Toit,* 2010; *Zhou, Wang,* 2013]. In short, an attempt was made to make the most universal selection of attributes possible, despite the understanding that the practice of CI is contextual, potentially conditioned even by the region of the globe in which it is practiced [*Blenkhorn, Fleisher,* 2010]. In addition, as it is an educational process directed at students with no experience in the area, basic knowledge, skills, and attitudes that could be learned by beginners were selected. Although this is not a validated list of attributes, the selected ones have the potential to encompass different formative situations — including within companies — aimed at individuals with no CI practice or in its early stages.

Having assessed DL, a new self-assessment questionnaire based on the same attributes was used for students to indicate the Degree of Importance (DI) of each attribute for the achievement of their own career strategy. Since the professional success desired by each student is represented by their career strategy, the power of DI is to point out the importance of attributes for achieving that success. It follows that the larger the group of attributes with high DL and DI simultaneously, the greater the course's contribution to increasing students' chances of professional success.

Thus, after a self-assessment of DL and DI, the group of attributes of competence with high DL (i.e. attributes highly developed as a result of CI learning promoted by the course) was compared with those with high DI (i.e. those pointed out as highly important for the achievement of the professional success desired by the students). This comparison showed the intersection between these groups, formed by the at-

Table 2. **Teacher deliverables assessment**

Deliverables (% of the total score)	Students' Scores					
	#1	#2	#3	#4	#5	#6
Internal Diagnostic Report — Part One (10%)	8.0	6.0	7.0	8.0	9.0	6.0
Internal Diagnostic Report — Complete (10%)	7.0	6.5	8.0	8.0	8.5	7.5
Internal Diagnostic Presentation — Pecha Kucha (5%)	8.0	7.0	9.0	6.0	10.0	8.0
External Diagnostic Report — Information Sources (5%)	6.0	8.0	8.5	7.0	9.0	9.0
External Diagnostic Report — Industry Information Collection / Porter's Five Forces (7,5%)	7.0	7.5	5.5	7.0	9.0	8.5
External Diagnostic Report — Macro Environmental Information Collection / STEEP Analysis (see Bensoussan and Fleisher, 2003) (7,5%)	8.0	7.0	7.0	5.0	10.0	4.5
External Diagnostic Report — Analysis Matrix of Collected Information (20%)	7.0	8.5	6.5	7.5	9.0	7.0
External Diagnostic Report — Complete (10%)	7.0	9.0	7.0	7.0	9.0	6.0
External Diagnostic Presentation — Pecha Kucha (5%)	7.5	9.0	6.0	7.5	10.0	7.0
Individual Career Strategy Report (15%)	8.5	10.0	7.5	8.5	9.0	8.0
Individual Career Strategy Presentation — Pecha Kucha (5%)	9.0	10.0	7.0	9.0	9.5	9.0
FINAL SCORE	**7.5**	**8.1**	**7.1**	**7.5**	**9.2**	**7.2**

Source: author.

tributes that had both high DL and high DI. The size and prevalence of the attributes of this intersection compared to the total allowed us to infer the influence of CI teaching upon students' chances of success

Results

This investigation into the relationship between students' learning and their chances of professional success assumes that they were able to achieve a good level of learning during the course. Two actions were fundamental to this objective: 1) the weekly review of students' individual CI project deliverables; 2) classroom discussions about these deliverables. This permanent feedback structure allowed students to understand their real learning level and, when necessary, to adjust their efforts. Besides, a proper understanding of their real learning would prepare students for a more conscious and realistic DL self-assessment.

In order to establish a reference for the analysis of the DL results, the teacher's deliverables assessment is presented in Table 2. The score ranged from zero (task completely incorrect or not completed on time) to 10 (task fully performed and with great practical results compared to what is expected for a student). The good overall performance of the class can be observed, something supported by using Active Learning and the small number of students in the class (only six). This positive learning outcome for the students is corroborated by the on-site observation of the teacher, which occurred mainly through the systematic feedback given to the students regarding their practical activities.

This result indicates a high probability that various competence attributes have high DL, since both express the same variable: student learning. Table 2 is particularly relevant because, despite the vast literature on self-assessment and its advantages (as in [*Dochy et al.,* 1999; *González de Sande, Godino-Llorente,* 2014], even for CI [*Keiser,* 2016], there is always concern about its effectiveness — especially in a study with few subjects. The teacher's assessment attesting to the quality of learning serves to dispel this fear.

Tables 3, 4, and 5 show the attributes of competence (knowledge, skills, and attitudes) that make up the course and were considered by students in their DL and DI self-assessment, their DL and DI levels indicated by the students, the median of these indications (column "MED."), the number of occurrences of DL and DI below the value considered the minimum threshold for stating that the DL and DI were high (column "x "), the sum of all occurrences below and above this minimum value (column" n "), and the critical value for the statistical significance α (two-tailed) of the median of DL and DI (column "C.V.").

The final four columns of DL and DI can be used to carry out a nonparametric statistical test called the Sign Test (see [*Sprent, Smeeton,* 2001]), used to estimate the significance of hypotheses for studies such as the present study (i.e., exploratory, without predefined statistical parameters that use the Likert Scale and have a small number of respondents).

The columns "Degree of Learning — DL" were numbered from 1 to 5 represent the number of students who indicated each of these five DL levels (Likert Scale): 1 — No learning or very little learning; 2 — Little/insufficient learning; 3 — Good/adequate learning; 4 - Very good learning; and 5 — Excellent learning beyond expectations. For DL, a value that exceeds Level 3 was considered high.

Likewise, the columns "Degree of Importance — DI" represent the number for the five adopted DI levels (Likert Scale): 1 — No importance (or very slight importance); 2 — Little importance; 3 — Good im-

portance; 4 — Great importance; and 5 — Essential/ Indispensable (the attribute is a critical success factor for professional success). For DI, a value that exceeds level 3 was considered high.

Discussion

Before discussing the results, it is important to point out that this study was based not on traditional indicators of professional success (such as salary increases, promotions, etc.), but on students' perception of their own success. We know that professional success is a multifaceted, circumstantial, and subjective concept. Therefore, it would not be possible to establish a definition in which all fit. Our choice in this research was to equip each student with the ability to: 1) establish their own vision of professional success; 2) represent it as an individual career strategy; and 3) evaluate the DI using this personal reference. Thus, the DI assessment, by pointing out the attributes of competence that increase one's chances of following a career strategy, indicates the attributes that increase the chances of professional success.

Another important issue is related to DL. Although this measure is, in some way, an expression of the quality of teaching, the instructions given to students before the DL evaluation and their feedback made it clear to everyone that the focus of the evaluation should be on the learning accumulated throughout the semester, and not the means for that learning (i.e., the discipline). In this context, the importance of teacher evaluations is reiterated (Table 2) as evidence of good student learning, which not only generates an expectation of high DL values, but also corroborates them (if they are high), as they will coincide with the conclusion reached by the teacher after monitoring and correcting students' work throughout the semester. Thus, the DL's perhaps restricted reliability due to the assessment method and the number of respondents is offset by the professor's assessment.

Considering that this research aims to determine whether a CI discipline has the power to leverage the true dreams of professional success of all its students or only those who will pursue a career in CI, first of all it is necessary to locate among the students those determined to become CI professionals, separate them from the others and analyze the DL and DI results for these two groups of students separately. To perform this separation, Table 6 was made, which presents a summary of students' dreams and goals for their professional success extracted from the individual career strategies developed by each student throughout the course.

In line with the previously described possibility, the table shows that none of the students expressed a clear desire to build a career in CI. Two of them are somehow connected to the informational job market due to the intention of developing technological solutions for the provision of services (students 2 and 6). Another one reports the desire to open a local supermarket (student 5), two others to pursue a master's degree (students 1 and 4), one to work preferably in the financial market (student 3), and another pointed out the desire to pursue a military career as a public servant (student 2). The consequence of this discovery is that, for the analysis of DL and DI, it will not be necessary to separate the students into two groups.

Another interesting conclusion from this table is that, although the students are from the same undergraduate course, there is a wide range of ideals among them. From the point of view of the Library and Information Science teacher, the finding that students mostly want to work on different job markets than the informational one can be surprising. However, from the research perspective, diversity rules out the possibility that the results of DI are only a reflection of the connection between the informational job market (the expected target for these students) and the competence attributes developed by CI teaching (linked to informational competence and therefore to the informational job market).

This evidence indicates that, by assigning a DI value to each attribute, students evaluated this variable without the bias that would be present if their main interest was to work on the informational job market. On the contrary, the assessment was based on the students' authentic dreams of professional success spread across different labor markets.

As already discussed, the fulfillment of the research objective depends upon identifying attributes with high DL and DI simultaneously. Therefore, it was necessary to indicate a criterion that established whether a value of DL and DI was high or not. In this study, DL was considered high when most of the students in the course — 50% or more — assigned either the degree of learning "very good" (Level 4) or "excellent/beyond expectations" (Level 5) to the attribute, in other words, any of the levels greater than 3. The same was true for DI, which was considered high whenever most of the students rated the attribute as either of "great importance" (Level 4) or "essential/ indispensable to their professional success" (Level 5).

In statistical terms, this criterion means that DL or DI will be considered adequate if the median value of the competence attribute is greater than 3. The median was chosen instead of the mean because it is a study whose distribution curve is unknown. Tables 3, 4, and 5 show the median values with the label "MED."

By observing the results exclusively from the perspective of the median, it can be said that all competence attributes reached the minimum value (i.e., 3) both for DL and DI. However, an analysis of the tables reveals that the attributes "K6", "S5", and "S9" have discrepant behavior with few evaluations above 3 and many below this value, when compared to the other attributes.

Even disregarding these three attributes, the results indicate that for most students, there was very good

Table 3. **Degree of Learning (DL) and Degree of Importance (DI) of Knowledge Attributes — Student Self-Assessment**

#	Assessed Knowledge	Degree of Learning — DL									Degree of Importance — DI								
		1	2	3	4	5	MED.	x	n	C.V.	1	2	3	4	5	MED.	x	n	C.V.
K1	What is Competitive Intelligence (CI)?	0	0	1	1	4	***5***	***0***	***5***	***0 (α=10%)***	0	0	2	2	2	***4***	***0***	***4***	–
K2	CI needs: what it is and how to do it	0	0	1	4	1	***4***	***0***	***5***	***0 (α=10%)***	0	1	1	2	2	***4***	***1***	***5***	–
K3	CI planning: what it is and how to do it	0	0	2	1	3	***4.5***	***0***	***4***	–	0	0	1	4	1	***4***	***0***	***5***	***0 (α=10%)***
K4	CI collection: what it is and how to do it	0	1	0	2	3	***4.5***	***1***	***5***	–	0	0	1	4	1	***4***	***0***	***5***	***0 (α=10%)***
K5	CI analysis: what it is and how to do it	0	0	0	4	2	***4***	***0***	***6***	***0 (α=5%)***	0	0	1	4	1	***4***	***0***	***5***	***0 (α=5%)***
K6	CI dissemination: what it is and how to do it	0	1	3	1	1	***3***	***1***	***3***	–	0	0	1	3	2	***4***	***0***	***5***	***0 (α=10%)***
K7	CI assessment: what it is and how to do it	0	0	2	2	2	***4***	***0***	***4***	–	0	1	1	2	2	***4***	***1***	***5***	–
K8	The internal environment of organizations: what it is and its main aspects	0	0	1	2	3	***4.5***	***0***	***5***	***0 (α=10%)***	0	0	1	4	1	***4***	***0***	***5***	***0 (α=10%)***
K9	The external environment of organizations: what it is and its main aspects	0	0	1	1	4	***5***	***0***	***5***	***0 (α=10%)***	0	0	1	3	2	***4***	***0***	***5***	***0 (α=10%)***
AVERAGE (%)		**0**	**5.6**	**16.6**	**30.6**	**47.2**	–	–	–	–	**0**	**7.0**	**16.6**	**48.6**	**27.8**	–	–	–	–

Source: author.

or excellent learning in various attributes that they considered to be very important or essential to their professional success. This represents the best combination of course efficiency (high student learning) and effectiveness (optimal future student benefit expectations).

The table below details the intersection between high DL and DI (except for "K6", "S5", and "S9"). Note that there is DL ranging from the simple majority (50% of students) to the totality (as in the case of "K5" for which all students reported very good or excellent learning). However, most are in the range of the simple majority and the vast majority (83.3%). In the case of DI, the attributes were concentrated in a range between 66.7% and 83.3%, indicating that the students evaluated the DI more positively than the DL. This may be due to the fact that the choice of attributes to be evaluated was particularly consistent with the students' career trajectories.

The table above also identifies the four attributes of knowledge (K4, K5, K8, and K9) and the three attributes of skill (S3, S7, and S8) with the best combination of learning and importance for success. This indicates that, for this particular class of students, these are the most strategic attributes. It is clear that the search for success is individual, therefore what matters most to each student are the attributes indicated by themselves as strategic. However, identifying the set of the most strategic attributes for each class may, over time, allow for an association to develop between the attributes and the profile of each class.

Considering that the focus of this study was to shed light on the connection between the competence attributes developed in an optional university CI course and the professional success idealized by the students, we believe that the analysis of the median represents the most adequate general indication of the success of the work. This is because having a small number of students is natural for this research context given the heterogeneous interests of undergraduate students at our university. Certainly, other scenarios for university teaching of CI may arise and ensure a larger audience, but in the same way, small classes will be typical.

It follows that much empirical research of this type (as well as the current study) will have an intrinsic limitation on the statistical significance of its results. The data in Tables 3, 4, and 5 make this clear: when submitting the attributes, previously endorsed by the median result, to the nonparametric Sign Test, we see that:

- in terms of DL, only one attribute reached 5% significance , eight reached 10% significance, and the others either did not allow any inference (because it is not possible to determine a critical region in the standard table of significance values) or were rejected;

[3] Significance obtained through a binomial probability table for p = 0.5 (two-tailed distribution).

Table 4. **Degree of Learning (DL) and Degree of Importance (DI) of Skills Attributes — Student Self-Assessment**

#	Assessed Skills	Degree of Learning — DL									Degree of Importance — DI								
		1	2	3	4	5	MED.	x	n	C.V.	1	2	3	4	5	MED.	x	n	C.V.
S1	Collect information from people and documents	0	1	2	1	2	***3.5***	***1***	***4***	–	0	1	1	0	4	***5***	***1***	***5***	–
S2	Assess the reliability of data and information	0	1	2	1	2	***3.5***	***1***	***4***	–	0	0	1	2	3	***4.5***	***0***	***5***	***0 (α=10%)***
S3	Classify and treat information collected for CI analysis	0	0	1	3	2	***4***	***0***	***5***	***0 (α=10%)***	0	0	1	3	2	***4***	***0***	***5***	***0 (α=10%)***
S4	Create conclusions and arguments with logic and traceability	0	1	0	4	1	***4***	***1***	***6***	–	0	1	1	2	2	***4***	***1***	***5***	–
S5	Establish implications after understanding context through CI analysis	0	2	2	0	2	***3***	***2***	***4***	–	0	1	1	3	1	***4***	***1***	***5***	–
S6	Make recommendations based on implications derived from CI analysis	0	1	2	1	2	***3.5***	***1***	***4***	–	0	1	1	4	0	***4***	***1***	***5***	–
S7	Describe the internal environment of organizations	0	0	1	3	2	***4***	***0***	***5***	***0 (α=10%)***	0	0	1	1	4	***5***	***0***	***5***	***0 (α=10%)***
S8	Describe the external environment of organizations	0	0	1	2	3	***4.5***	***0***	***5***	***0 (α=10%)***	0	0	1	3	2	***4***	***0***	***5***	***0 (α=10%)***
S9	Perceive the true strategy/strategic goals of organizations	0	1	3	1	1	***3***	***1***	***3***	–	0	1	1	2	2	***4***	***1***	***5***	–
S10	Extract from CI results, ideas and opportunities to leverage the success of organizations	0	0	2	3	1	***4***	***0***	***5***	***0 (α=10%)***	0	0	2	2	2	***4***	***0***	***4***	–
AVERAGE (%)		**0**	**12.8**	**26.9**	**29.5**	**30.8**	–	–	–	–	**0**	**7.7**	**21.8**	**33.3**	**37.1**	–	–	–	–

Source: author.

- in terms of DI, one attribute reached 5% significance, 10 reached 10% significance, and the others did not allow inference or were rejected;
- only six attributes had simultaneously high values of DL and DI with statistical significance — one of them ("K5") with 5% significance and the others ("K8", "K9", "S3", "S7", and "S8") with 10% significance (the similarity between this list of attributes and the one indicated in Table 7 stands out as being the most representative attributes of the class).

This limitation in terms of statistical significance would indicate, for many studies, sampling and/or experimental deficiencies. However, for this study this result stems from an intrinsic feature of the research –one representation of the reality at numerous universities that offer CI optional subjects — that is, the small number of students enrolled. Still, we believe that the results serve their fundamental purpose, despite the generalization issues: adding insights and new possibilities to the existing literature. By not drawing any definitive conclusions, this study bypasses the statistical limitations by pointing out a new connection between CI teaching and the expectations of genuine professional success among undergraduate students.

Conclusions

Do the students who enroll in a university CI course but who do not aspire to pursuing a career in this area only achieve that more general employability or do they find the "right employability" thanks to the course? Or, in other words: does a CI discipline have the power to leverage the true dreams of professional success for all of its students or only those who will pursue a career in CI? To answer these questions, the present work investigated whether a CI undergraduate discipline could develop competence attributes (knowledge, abilities, and skills) indicated by the students as strongly connected with their professional success expectations.

Six university students participated in an CI course and at the same time developed their individual career strategies. At the end of the teaching process and

Table 5. **Degree of Learning (DL) and Degree of Importance (DI) of Attitudes Attributes — Student Self-Assessment**

#	Assessed Attitudes	Degree of Learning — DL									Degree of Importance — DI								
		1	2	3	4	5	MED.	x	n	C.V.	1	2	3	4	5	MED.	x	n	C.V.
A1	Motivation to understand the internal environment of organizations	0	0	3	1	2	***3.5***	***0***	***3***	–	1	1	0	2	2	***4***	***2***	***6***	–
A2	Motivation to understand the external environment of organizations	0	0	2	3	1	***4***	***0***	***4***	–	1	0	1	3	1	***4***	***1***	***5***	–
A3	Analytical thinking about organizational issues	0	0	2	3	1	***4***	***0***	***4***	–	0	1	1	1	3	***4.5***	***1***	***5***	–
A4	Strategic look at key organizational issues	0	0	3	2	1	***3.5***	***0***	***3***	–	0	1	1	0	4	***5***	***1***	***5***	–
A5	Critical sense of decisions and/or strategic actions of organizations	0	1	2	2	1	***3.5***	***1***	***4***	–	0	1	0	3	2	***4***	***1***	***6***	–
A6	Discernment to discuss strategic issues of organizations	0	1	2	2	1	***3.5***	***1***	***4***	–	0	1	1	1	3	***4.5***	***1***	***5***	–
A7	Confidence to participate in decisions and/or strategic actions of organizations	0	1	2	3	0	***3.5***	***1***	***4***	–	0	0	2	1	3	***4.5***	***0***	***4***	–
A8	Confidence and discernment to contribute to the success of organizations	0	2	1	2	1	***3.5***	***2***	***5***	–	0	0	1	3	2	***4***	***0***	***5***	***0 (α=10%)***
AVERAGE (%)		**0**	**11.7**	**28.3**	**36.7**	**23.4**	–	–	–	–	**3.3**	**8.3**	**11.6**	**26.6**	**50.0**	–	–	–	–

Source: author.

the creation of individual career strategies, students used a questionnaire based on attributes of competence related to CI to self-evaluate 1) the Degree of Learning (DL) of each attribute from the teaching process and 2) the Degree of Importance (DI) of each attribute for fulfilling their own career strategy.

Using the results of DL in association with the teacher assessment of the students' deliverables (Table 2), it was possible to establish that CI learning was positive for all students. On the other hand, self-evaluation showed high DL and DI medians for almost all attributes. The union of these results indicates that the teaching process was able to promote effective CI learning in various attributes of competence considered important by students for their professional success, which indicates that CI teaching increases individuals' chances of professional success.

The small number of students limits the generalization of these findings, in addition to the fact that the group is homogeneous in several characteristics (most are young with no professional experience). Besides that, the development of the students' individual career strategies in parallel with the CI teaching continually sparked a debate in the classroom about how CI could support the success of each one. The result was a strong interaction between the researcher and the research object and the need for research itself to be framed as active research, since it is a method aimed at empirical research in which researchers and participants are involved in a cooperative or participatory way.

All of these arguments make the traditional generalization unfeasible. On the other hand, for different sciences such as Administration, Information Science and Education, an exploratory study that is not generalizable and even carried out with a small number of participants may be relevant, given its capacity to add a new element to the existing literature and increase the researcher's familiarity with a new or complex problem. Recognizing their own nature, exploratory studies with small populations do not claim to present definitive conclusions. Rather, they try to present new constructs (as is the case with this study, which seeks to establish a relationship in the literature between the university CI teaching and the leverage of the students' professional success).

As already stated, it is likely that both the attributes developed by CI courses and the students' professional dreams vary according to the country and its socio-professional context. CI teachers in their universities establish their pedagogical project and their tools for assessing students' learning in those competence attributes upon which your courses were based

Table 6. **Dreams and goals that characterize the students' professional success**

Student	Dreams and goals
#1	In the beginning, it is having a very comfortable salary in the short term, enabling me to make a living without needing anyone. This means growing professionally and generating a meaningful network of contacts to prevail upon and be active with my business on the job market. In the near future, to be able to set up my own company and be influential in the segment I want to operate in, which is the technological sector. Create a 100% digital and multichannel platform to interact in a practical, ethical, and efficient way for everyone who uses it.
#2	I want to conclude college with high marks and then pursue a master's degree. Then I want to enter the job market and, in parallel, study and seek information about a public tender that accepts my college degree. In the future, be approved in a public tender for the Army and pursue a military career.
#3	In general terms, it is doing something every day with pleasure and using the utmost of my creative abilities and accumulated experiences and knowledge exponentially, collaborating for research, teaching, and transforming the world for many people. The essence of success is precisely this union: sharing and absorbing knowledge every day, doing something that really makes a difference for me and for those who relate to me directly or indirectly. Concretely, my short and medium term goals are to earn my master's degree, to be able to teach during open hours (at night) and to be able to finish my master's studies and work at a company.
#4	Achieve financial independence (get rich on the financial market), study more and work as little as possible (enjoying life without becoming a slave to work, a jester). I don't want to sell my time working for other people unless it contributes considerably to my personal development. Never be the jester, the madman who possibly becomes a beggar, not necessarily some people we see begging in the streets, but in the mental, emotional, and financial sense, with poverty in almost all aspects of his life, victimized by nature, always passive in the situation that life offers, a believer of predetermination and destiny.
#5	Being able to finish the Library and Information Science course to better structure myself financially and get enough capital to open my own business (a small supermarket). Start doing a new undergraduate course in Mathematics.
#6	Until I am 40, I would like to be in charge of major projects for companies or in my own company where I can create, redefine, and project new experiences in people's lives. There is no specific economic sector like food or clothing, but any one where I can change the way people behave in their spare time through a new concept, idea, or technological product.

Source: author.

Table 7. **DL and DI of intersection attributes**

		Degree of Importance (DI)				Total
		50% (3 students)	**66.7%** (4 students)	**83.3%** (5 students)	**100%** (6 students)	
Degree of Learning (DL)	**50%** (3 students)	---	S1, S6, A1, A4, A6, A7	S2, A5, A8	---	9
	66.7% (4 students)	---	K7, A2, A3	K3	---	4
	83.3% (5 students)	---	K1, K2, S4, S10	K4, K8, K9, S3, S7, S8	---	10
	100% (6 students)	---	---	K5	---	1
Total		0	13	11	0	24

Source: author.

(in the same way as it was done here, with DL). In the same way done here, they can seek the connection between the attributes with high DL and the professional success genuinely desired by the students, which represents the DI (of course, as long as the students receive - either from the CI teacher or by other means - the necessary assistance to discover their authentic image of success). Having access to this pathway previously absent from the literature can be of great benefit to CI teachers around the world who wish to offer education aimed at professional success.

This research indicates that CI teaching — all types or just those like the course described here — can leverage professional success, even for those who do not wish to work as CI professionals. Further research will be necessary to fully generalize this conclusion, but to know that this is real even under some circumstances creates good opportunities for teachers and students. In the end, we believe that CI teaching can create a legion of professionals with diverse backgrounds working on different labor markets, who are convinced that CI can benefit them in their pursuit of their own professional success.

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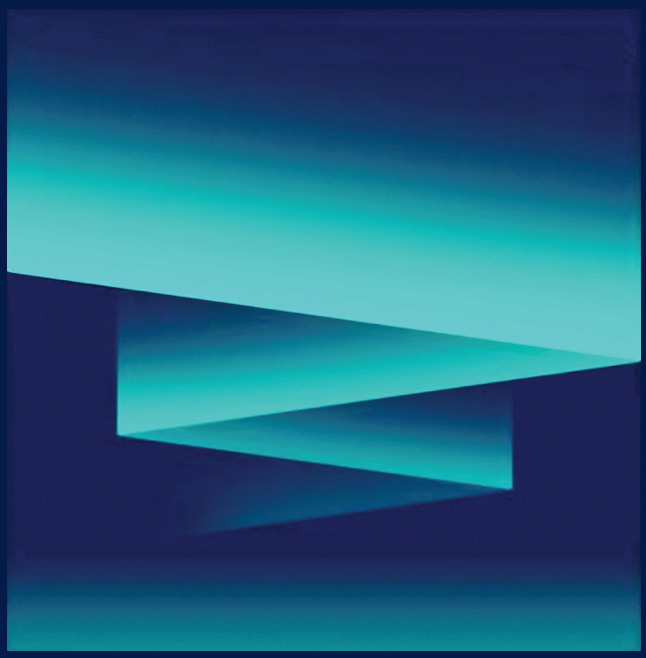

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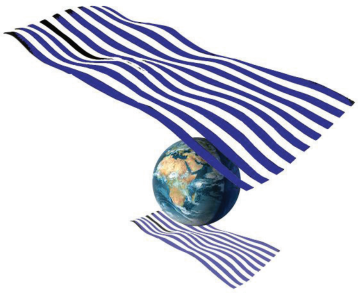

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