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On the relationship between competitive intelligence and innovation

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ABSTRACT Innovation research suggests customer, competitor and market knowledge are important requirements for innovation. Researchers in competitive intelligence (CI) have proposed that there should be a relationship between CI and innovation. Yet despite both fields recognising the need for CI and related areas for innovation in their theories, there have not been many empirical studies that look at CI and innovation and those few studies that do exist have limited focus and have only looked at a small subset of CI variables (for example collection sources). The aim of this study is to examine if there is a relationship between CI and innovation. This was done by surveying Strategic and Competitive Intelligence Professional (SCIP) members and those attending SCIP events, and asking them about their intelligence practices and how innovative their company was. Ninety-five questions were asked about CI structure and organization, intelligence focus, information sources used, analytical techniques used, communication methods, and the management of the intelligence efforts. Of the 95 competitive intelligence measures used in this study, 56 (59%) were significantly correlated with the study's measure of innovation. The measures within the CI organizational elements and CI management categories had the highest percentage of measures significantly correlated with innovation (90% and 89%). Four of the CI measures had statistically significant correlations above .300. These included the extent to which business decisions in the organization were better facilitated/supported as a result of intelligence efforts (.355), the number of performance measures used in assessing CI's performance (.322) and decision depth (.313), which is a measure of the number of decisions that utilized CI. As a study of this nature measuring the relationship between CI and innovation has not been conducted previously, the findings can be beneficial to organisations using innovation to succeed in the competitive environment.

KEYWORDS Competitive intelligence, competitive intelligence practices, environmental change, innovation

1. INTRODUCTION

Innovation according to researchers within both the competitive intelligence and innovation fields requires an understanding of the competitive environment (Christensen et al. 2015, Paap and Katz 2004, Dogan 2017). This competitive environment is one that has been "rapidly changing where new competitors are entering the marketplace, and where current competitors are offering new products" (Nasri 2012, 25). For organisations to survive in this environment, they need to be effective and proactive in identifying and responding to the opportunities, challenges, risks and

limitations posed by the external environments that they operate in. Thus, innovation requires anticipatory capabilities through approaches such as competitive intelligence.

While there is a plethora of research on innovation, very little of it looks at the link between competitive intelligence (CI) and innovation. Further, as will be shown in this paper, the few studies that do look at CI focus only on selected aspects of CI and their link with CI (for example information collected), or on one dimension of intelligence practices (such as competitive technical intelligence). There has not been a study of the influence of each construct of the CI cycle with that of innovation. This includes the extent of formal intelligence structures, planning of CI projects, collection of information used for intelligence, analytical techniques used, communication of CI information, evaluation or management of CI. This paper takes a comprehensive view of CI including ninety-five CI variables and examines the relationship between these variables and innovation from CI practitioners.

2. LITERATURE REVIEW

2.1 Competitive intelligence

The CI Professional Association (SCIP) defines CI as "a necessary, ethical business discipline and/ or skillset for decision making based on understanding the competitive environment in order to drive to 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" (www.scip.org). As this definition is one that is provided by the SCIP and it encompasses the integrated nature of CI, it aligns well with the current study and will therefore be adopted as the definition of CI.

This definition is consistent with the research by Du Toit (2015, 15) who provided a definition based on meta-analysis of 338 articles about CI between 1994 and 2014. The article defined CI 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".

When assessing CI practice, researchers start with this and similar definitions and then survey practitioners regarding the extent to which they are conducting activities in a manner consistent with this definition. This includes asking questions about how the organization plans their intelligence activities, collects information (how they do it, what information), how it is analysed, communicated and how the intelligence process is managed (see Fehringer et al 2006, Calof et al. 2018). M-Brain's market intelligence framework and benchmarking tool assesses CI activities by looking at the scope of CI activities, stakeholder management, process, digitalization, deliverables, tools, organization, management & leadership and culture (M-Brain 2020). The CI field in examining intelligence practice looks at how intelligence projects are run (the intelligence process) and how the intelligence process is managed. This is a broad holistic view of intelligence and the one adopted in this study.

2.2 Innovation and competitive intelligence

Innovation is a very popular research topic, and much has been written about it. A search on ABI-INFORM ProQuest on 24 April 2020 on peer reviewed publications with "innovation" as a subject found 45,561 articles. Within this large stream of peer-reviewed articles on innovation, those that focus on CI or market insight and innovation are relatively small. A search for the terms "Innovation and competitive intelligence" in the subject field yielded only 29 articles. Expanding the search to include areas related to intelligence such as market insight and also environmental scanning did not increase results by much. While there are many articles where the terms competitive intelligence and innovation appear, these are not the focus of the paper (which is why subject matter was used). We changed the search to be "competitive intelligence" and innovation with the limitation being that it had to appear anywhere besides the full text as this would provide a second level of importance. This increased the total number of documents found to 76 articles, again not a lot. Thus, it appears

that despite the growing popularity of innovation research, little of it has focused directly on CI and innovation. An additional search was conducted on Google Scholar using the terms "competitive intelligence and innovation" specifically looking for research conducted in the last two decades (2010-2020) and this revealed 103 articles. While there were some overlaps in the articles already found on ABI-INFORM ProQuest, some more recent publications were identified from the 103 articles and used for the literature review.

The articles that were found in this literature search fell into two broad categories: 1) research done by CI researchers who used constructs and theories from CI to examine the extent to which CI could help innovation and 2) research done by innovation researchers that focused more on innovation theory and constructs but would then look at how CI and CI related topics could improve innovation. Table 1 provides a sample of the literature reviewed and information about these studies including the aspect of CI studied and how innovation was defined. Brief details of the methods used for the studies are also reflected in the table including whether the study was empirical or theoretical. All 20 studies found in both the subject matter searches were found to be suitable for this study and are summarized.

A few observations emerge from Table 1 that necessitate this kind of study:

1) Half the studies are theoretical and not empirical, thus there have not been many empirical studies done.
2) Those studies that were empirical focused the CI portion of their study on only a subset of the organizations' CI activities. This will be described in more detail below.
3) There is no consistency in how innovation measurement or performance is being conceptualized. For example, Cerny (2016) looks at innovation management and Dogan (2017) looks at strategic innovation. Perhaps the most frequently occurring innovation construct in Table 1 is around market leading innovation as embodied in Duan et al. (2020) with new product development, Lee and Lee (2017) with business opportunity, Tahmasebifard (2018) with market performance, and Tainev and Bailetti (2008) with innovation performance.

Several researchers have proposed that there should be a relationship between CI and innovation but for the most part these have been theoretical studies (e.g. Vargas et al. 2017, Mihaela, Sabin and Raluca 2017, Veugelers, Bury and Viaene, 2010). Those studies that have been empirical in nature have tended to limit their focus on the impact of CI on innovation using only a small subset of CI practice variables. For example, Tanev and Bailetti (2008) only looked at the kinds of information gathered and their relationship to innovation. Poblano-Ojinaga et al. (2019, 62) looked at the basic collecting and analysing information, predicting market movements and technology changes into consideration when determining the relationship between CI and innovation capabilities. In total this study had only a handful of questions about CI. Furthermore, the authors acknowledged that their findings reflected a lack of sufficient statistical evidence to prove their hypotheses that CI influences innovation capability and CI influences intellectual capital. Hence the current study is essential and timely to respond to the findings of Poblano-Ojinaga et al. (2019, 65).

In summary, there are not a lot of papers focusing on CI and innovation. Half of those that we found are theoretical and the empirical studies only looked at a limited number of CI variables.

3. METHODOLOGY

The objective of this study is to examine if there is a relationship between CI and innovation. This was done by asking CI practitioners how effectively they felt their organization coped with changes in the business environment with innovation related selection options and correlating this response with CI.

3.1 The competitive intelligence measurement

A survey was developed by the study authors. The survey was revised based on the one used in 2006 by Fehringer, Hohhof and Johnson (2006) and modified to reflect research on CI practice conducted since that time and reported either in the academic literature or the professional literature and discussions with CI practitioners and academics. The revised questionnaire was then sent to five leading CI academics and practitioners for comment and validation. The revised survey was pre-tested on SCIP members and revised again based on their feedback.

Table 1 Literature on CI and innovation concepts and measures. Method: E = empirical, T = theoretical.

Author/date	CI constructs	Innovation constructs	Method	Measures Used
Cerny (2016)	Competitive Technical Intelligence	Innovation Management	E	Collection, analysis
Dogan (2017)	Strategic intelligence	Basic elements of strategic innovation	T	Culture, structure, systems and processes
Duan, Cao, & Edwards, (2020)	Business Analytics, environmental scanning, data-driven culture	New product development and meaningfulness	E	Business analytics directly improves environmental scanning which in turn helps to enhance a company's innovation
Eidizadeh, Salehzadeh, & Ali, (2017)	Business Intelligence	Organisational innovation	E	Collecting, processing, knowledge sharing (dissemination)
Lee & Lee (2017)	Competitor intelligence	Business opportunity	T	Data collection, analysis
Mihaela, Sabin & Raluca (2017)	Competitive intelligence	Innovation strategy	T	Collect, compile, analysis, communicate
Nemutanzhela & Iyamu (2011)	Competitive Intelligence	Information systems (IS) innovation	E	Collection, dissemination of information - awareness
Norling et al. (2000)	Competitive Technical Intelligence (Planning, collecting, analysing and dissemination)	Innovation Process	T	Intelligence resources used to seek out technology opportunities.
Paap and Katz (2004:13)	Anticipating change and drivers of technology	Disruptive Innovation	T	Managing disruptive technologies by detecting new technology and customer needs
Paap (2007)	Competitive technical intelligence	Innovation New product positioning	T	Planning; collection, assessment (evaluation)
Poblano-Ojinaga, López, Gómez, & Torres-Arguelles (2019)	Competitive Intelligence	Innovation capabilities, IP, Early Warning	E	Collection, analysis of information
Spinolaa, Bezerrab, & Gregolina, (2008)	Competitive intelligence	Technological innovation	E	Identification of needs, planning, collection, analysis, dissemination and evaluation.
Tahmasebifard, (2018)	Competitive Intelligence, Market intelligence, Competitor intelligence, Technological intelligence	Market performance	E	General CI activities
Tarek et al. (2016)	Competitive Intelligence, Business Intelligence	Mediation and moderation effects of innovation	E	Collection, analysis and processing, sharing and dissemination, and memorizing of strategic information
Tanev & Bailetti (2008)	Competitive intelligence	Innovation performance	E	Information collection
Vargas, Perez & Franco (2017)	CI Practice	Disruptive innovation	T	CI can be an important aid to managers of established organizations on predicting and acting in the face of Disruptive Innovations.
Veugelers, Bury and Viaene (2010)	Technology intelligence	Disruptive innovation	T	Planning, Collection, analysis, reporting
Watts et al. (1998)	Competitive technical intelligence	Technological innovation	T	R & D Profile, Supporting Technologies, Gap analysis
Zhang et al. (2015)	Competitive technical intelligence	Technology road mapping	T	R&D, existing and potential collaborations in technology development, technological trajectories
Zhang et al. (2016)	Technical intelligence	Technological forecasting	E	Data collection, analysis

Based on the Fehringer et al. (2006) survey, literature review, discussions, expert review and pre-test, the final survey had 95 questions that looked at various aspects of CI practice that are reported in this paper. Ten questions were asked about CI organization (such as structure, formal processes, employee involvement in CI). Six questions were asked about the amount of time spent in each phase of the intelligence process. Twenty-five

questions were asked about intelligence planning and focus activities. Seventeen questions were asked about the sources of information used for CI. Thirteen questions were asked on analytical techniques used. Ten questions were asked about the methods used to communicate intelligence and fourteen questions about how CI was evaluated. Further details on the design and delivery of the survey is elaborated on in Calof, Arcos and Sewdass (2018, 663).

3.2 Measuring innovation

We adopt a measure of innovation that is based on how the organization copes with changes in the environment. The question posed was "In your opinion, how well does your organization cope with changes in the business environment?" Respondents could select from four options which ranged from "we are the leaders in innovation – we drive the change" to "we do not cope well – below average"

In using this approach, we follow the conceptualization of innovation as espoused by leading innovation writers who advocate that innovation is about responding to factors within the business environment. For example, one of the best-selling innovation books is "Innovation: The Five Disciplines for Creating What Customers Want" (Carlson and Wilmot 2006). Clayton Christensen developed a theory of disruptive innovation which he introduced in 1995, which has as its key tenants challenging existing competitors by improving products and services in a way that exceed the needs of some segments of the market (customers) with competitors either underestimating the threat of the new technology or being slow to respond (Christensen, Raynor and McDonald 2015). Thus, much of the innovation literature does suggest that innovation is about leading the market (being disruptive). By asking the respondent how they respond to changes in the environment and if in fact they lead/drive the change would therefore be a conceptualization of Christensen's disruption innovation and Carlson and Wilmot's Five Disciplines.

We recognize that while this measure of innovation is consistent with the theory in the innovation, the field does have far more measures such as patents filed and sales from new products and in most of the innovation studies multiple measures are used, but for this study how well respondents cope with changes in their business environment with one of the options being that they lead the change (innovation) can be viewed as a suitable measure of innovation. However future studies should use more complex measures that are more consistent with the innovation field.

The final survey which contained the 95 CI dimension questions and the one innovation question was then sent to SCIP members and also distributed at SCIP events (chapter meetings and conference). With the help of SCIP, 420 surveys were returned of which 248 had details of all elements of their CI activities while the remainder had only partial details (defined as between 25% and 75% of the questionnaire filled in).

4. STUDY RESULTS

How innovative were the respondents? Four hundred and twenty replied to the study's innovation measure. Ten percent replied that they drove change within their industry and that they were leaders in innovation; 31% were above average in dealing with industry change; 46% were average and coped with environmental changes, while 13% responded that their companies were below average. The range in responses to the innovation question, coupled with the large number of responses, provides a rich base of information to examine the elements of intelligence associated with the study's operationalization of CI.

For this study, we correlated 95 measures of CI with the innovation measure. Of these, 56 (59%) were significantly correlated with the study's measure of innovation (Table 2). The measures within the CI organizational elements and CI management categories had the highest percentage of measures significantly correlated with innovation (90% and 89%). Four of the CI measures had statistically significant correlations above .300. These were the extent to which business decisions in the organization were better facilitated/supported as a result of intelligence efforts (.355), the number of performance measures used in assessing CI's performance (.322) and decision depth (.313), which is a measure of the number of decisions that utilized CI. Not having any CI performance measures had a -.301 correlation with innovation. Thus, at the onset it appears that those CI functions that were more integrated into the organization's decision making with clear performance measures were associated with organizations that were more innovative. The remainder of this section provides details on the study results for the 95 measures.

Table 2 Summary of study results. M/Q = Number of measures per questions asked; Stat Sig = Number statistically significant; % Sig = Percent significant.

Correlations between:	M/Q	Stat. Sig.	% Sig.
CI organizational elements and innovation	10	9	90%
Time spent in each phase of the intelligence process and innovation	6	3	50%
CI planning and focus and innovation	25	19	76%
Sources of information used for CI and innovation	17	3	18%
Analytical techniques used for CI and innovation	13	6	46%
Methods used for communications of CI and innovation	10	4	40%
How CI is evaluated and managed and innovation	14	12	86%
Total	95	56	59%

Table 3 (a)The relationship between having a CI unit and innovation. Below Avg. = Innovation: below average (of a total 25); Avg = Innovation: average (of a total 118); Above Avg. = Innovation: Above average/leads (of a total 105); (b) A.Sig= Asymptotic Significance (2-sided); a. 1 cells (16.7%) have expected count less than 5. The minimum expected count is 2.92. (c) ASE = Asymptotic Standard Error (Not assuming the null hypothesis); T App = Approximate T (Using the asymptotic standard error assuming the null hypothesis); Sig App = Approximate Significance (Based on normal approximation).

(a)	Below Avg.	Avg.	Above Avg.
We have a CI unit (219)	19	101	99
We don't have a CI unit (29)	6	17	6

(b)	Value	df	A.Sig
Pearson Chi-Square	8.143[a]	2	.017
Likelihood Ratio	8.095	2	.017
Linear-by-Linear Association	8.101	1	.004
N of Valid Cases	248		

(c)	Value	ASE	T App.	Sig App
Interval by Interval Pearson's R	.181	.063	2.888	.004
Ordinal by Ordinal Spearman Correlation	.179	.060	2.847	.005
N of Valid Cases	248			

4.1 CI organizational variables and innovation

The survey explored many dimensions of CI organization and structure. As mentioned in the overview, those organizations that responded that they had a CI function that informed decisions were more innovate. There were however nine additional measures of CI organization used.

The study asked questions about several elements of the CI organization starting with if they have an intelligence unit. Table 3 presents the correlational information, and associated tables. With a significant positive correlation of .181, it was evident that having a CI unit was positively associated with innovation. In looking further at the crosstabs, which were also statistically significant, innovation appears to be associated with having an intelligence unit. Of the firms that said they either were above average or lead the industry, 94% had an intelligence unit.

Questions were also asked about the structure of the CI function and its role within the organization. The correlation between the 10 CI organization questions and innovation are provided in Table 4.

Table 4 Association between intelligence organizational variables and innovation. *Correlation is significant at the 0.05 level (2-tailed). **Correlation is significant at the 0.01 level (2-tailed).

CI Organizational variables	Correlation with innovation
Business decisions are facilitated/supported as a result of CI	.355**
Full time CI resources	.136*
Formal CI strategy	.145*
Formal CI procedures	.153*
CI ethical guidelines	.111
Manager with CI responsibilities	.185**
Employees know about CI	.222**
Employees participate in CI	.271**
Years that the CI function been in existence	.170**
Do you have a CI function	.181**

Respondents were asked about whether their organization had a formal CI strategy, specific CI ethical guidelines and a manager with CI responsibilities. These are measures of CI formality and in all cases were positively associated with innovation. Part of CI formality is the extent to which it informs management decision (integration into the

senior management of the organization) and the extent to which employees are aware of the function and participate in its activities. All correlations between these measures and innovation were positive and statistically significant, with its role in informing decisions at .355 and employees participating in it at .271 having the highest correlations to innovation in this category. Integrating all employees in an organization's intelligence effort has long been acknowledged as something that enhances CI performance (Calof, Santilli and Richards 2018). It is also associated with innovation in the open innovation literature (Veugelers, Bury and Viaene 2010).

4.2 4CI process dimensions and innovation

As mentioned in the literature review section, intelligence is developed, not collected. Thus, the CI literature focused on intelligence as an outcome of what is termed the wheel of intelligence, which involves planning, collection, analysis, communication and various management activities. In the study, respondents were asked what percent of intelligence time was taken in each of these activities (the total had to add up to 100%). Table 5 provides the correlation of the time spent in each phase of the intelligence process with innovation. Three out of the six correlations were significant. Management of CI measures (managing the project and evaluating the intelligence project) were significantly and positively correlated with innovation while collection was negatively correlated with innovation. This latter result would appear to indicate that spending more time collecting information as part of the CI project leads to lower innovation. CI theorists have consistently stated that intelligence involves a lot more than just collection and that in fact past studies have put collection time around 25% of total intelligence activity (see Calof et al 2018).

4.3 CI planning/focus and innovation

Three sets of questions looked at the focus of the organization's intelligence efforts. This is a key dimension of planning: business decisions supported by CI, temporal orientation of the intelligence projects (how forward-looking they were) and CI deliverables. In addition, there was a question about formal planning for trade show intelligence. Table 6 provides the correlations between these three sets of planning questions and the study's innovation measure.

4.3.1 Business decisions supported by CI

Respondents were given eight decisions and asked to assess the extent to which CI supported these decisions. All eight were significantly correlated with innovation. Decision depth (a composite measure of the eight decision areas supported by CI) had the one of the highest significant correlations in the entire study (.313) with research/technology development being the most strongly correlated decision with innovation, followed by customer profiles (.256).

Table 5 Process dimension- The wheel of intelligence.
*Correlation is significant at the 0.05 level (2-tailed).
**Correlation is significant at the 0.01 level (2-tailed).

CI process dimension	Correlation with innovation
% CI time spent Planning your intelligence project	0.122
% CI time spent Collecting the information	-.134*
% CI time spent in Analysis (piecing together collected data and analyzing)	-0.031
% CI time spent communicating the intelligence (formatting intelligence deliverables, reports, writing the reports)	-0.064
% CI time spent Managing the project including meeting with clients	.149*
% CI time spent Evaluating the intelligence project	.146*

4.3.2 Temporal orientation of CI projects

Respondents were asked to break down the percentage of intelligence projects undertaken by how forward-looking they were. Four categories were provided: less than one year, one to five years, five to ten years and over ten years. The total percentage for the four categories had to add up to 100%. Of the four, two had significant correlations with innovation: temporal orientations of over ten years with a .199 correlation and under one year with a negative correlation of -.149. This suggests that shorter temporal orientations are negatively associated with innovation and longer-term orientations associated with higher levels of innovation.

Table 6 Planning and focus dimensions and innovation. *Correlation is significant at the 0.05 level (2-tailed). **Correlation is significant at the 0.01 level (2-tailed).

CI planning and focus questions	Correlation with innovation
Decision depth	.313**
CI supports Research or technology development	.268**
CI supports Market entry decisions	.247**
CI supports Reputation management/ Communication/ Public relations	.243**
CI supports Regulatory or legal	.209**
CI supports mergers & acquisitions, Due Diligence or Joint- Venture assessment	.177**
CI supports Sales or business development	.158*
CI supports Corporate or Business strategy decisions	.148*
CI supports Product development	.137*
CI temporal focus percent More than 10 years	.199**
CI temporal focus percent Less than 1 year	-.149*
CI temporal focus percent 6 - 10 years	0.119
CI temporal focus percent 1 - 5 years	0.074
Competitive intelligence product depth	.284**
Customer profiles	.256**
Supplier profiles	.250**
Technology assessments	.231**
Early warning alert	.215**
Executive profiles	.199**
Political analysis	.155*
Competitive benchmarking	0.106
Economic analysis	0.098
Market/Industry report/analysis	0.039
Company profiles	0.031
Trade show intelligence plan done	.215**

4.3.3 Competitive intelligence products or deliverables

Respondents were given a list of ten different CI products/deliverables and asked to assess the frequency each was done using a four-point Likert scale (from never to frequently). Six of these were significantly correlated with innovation. Customer profiles, supplier profiles, technology profiles and early warning alerts were the most strongly correlated with innovation, with correlations above .20.

These results collectively appear to indicate that innovation is more correlated with an intelligence focus that covers more areas of their external environment, is focused longer term and in which technology, customers and suppliers are focused on.

Finally, in terms of formal planning within CI activities, there was a significant and positive correlation between doing a trade show intelligence plan and innovation (.215). What is interesting about this result is the information collection question (discussed in the next section) which did not yield a statistically significant correlation with innovation, although having a trade show intelligence plan did. This suggests that planning for collection activities may be more linked to innovation than the collection activities themselves. This is consistent with the view in intelligence that focus and planning are important.

4.4 CI collection and innovation

In the survey, participants were given a list of seventeen sources of information and asked to evaluate the importance of each to their organizations CI efforts. Of all areas in the study, collection sources yielded the fewest statistically significant correlations with innovation (Table 7). Of the 17 sources, only three were statistically significant. Only use of social media in general and Twitter, blogs and wikis had positive correlations with innovation. In general, the kinds of information used beyond social media did not appear to have an association with innovation.

Table 7 Information sources used innovation. *Correlation is significant at the 0.05 level (2-tailed). **Correlation is significant at the 0.01 level (2-tailed).

Information sources use	Correlation with innovation
Publications (print/online)	-0.073
Internet websites (free)	0.006
Commercial databases (fee)	-0.005
Social media	.198**
Internal databases	0.072
Company employees	0.089
Customers	0.088
Suppliers	0.088
Industry experts	0.102
Government employees	0.059
Association employees	0.089
LinkedIn used for CI	0.068
Facebook used for CI	0.108
Twitter used for CI	.165**
Blogs / Wiki used for CI	.228**
Wiki	0.137
Trade show/conference importance for CI	0.090

4.5 CI analysis and innovation

Those surveyed were asked if they used analytical techniques in their CI activities. In total, 84% responded that they did. There was

no significant correlation between using analytical approaches and innovation. The correlation was extremely low and not statistically significant (.088, Table 8). However, taken individually, several of the analytical techniques were correlated with innovation: business analytics, benchmarking, technology forecasting, scenario analysis, financial analysis and customer segmentation analysis were all positively correlated with innovation. This would suggest that it is not doing the analysis that is associated with being innovative but the kind of analysis you are doing. For example, several of these techniques are associated with technology-oriented analysis (benchmarking, technology forecasting, and scenario analysis). Technology oriented intelligence topics as mentioned earlier had higher correlations with innovation and those intelligence topics that are more forward-looking temporally (which are associated with technology) are also more positively associated with performance. From the planning and analysis sections it appears that focusing on technology and customers and being more forward-looking is more associated with innovation.

Table 8 Analysis and innovation. *Correlation is significant at the 0.05 level (2-tailed). **Correlation is significant at the 0.01 level (2-tailed).

Analysis question	Correlation with innovation
Does your organization use Analytical Methods or Models to generate CI?	0.088
Business analytics for competitive intelligence	.288**
Benchmarking (Best practices)	.160*
Technology Forecasting	.156*
Scenario Analysis	.148*
Financial Analysis and Valuation	.132*
Customer Segmentation Analysis	.128*
SWOT Analysis	0.097
Indications and Warning Analysis	0.087
Competitor Analysis	0.077
Industry Analysis	0.043
Patent Analysis	-0.031
Competitive Positioning Analysis	-0.098

4.6 CI communications and innovation

The survey asked about the use of nine different communication methods for intelligence findings (there was also an "others" category) and a composite score called communications depth. Only four of these had a statistically significant correlation with innovation with the highest being warning alerts at .205 (Table 9). This is consistent with the literature where Duan, Cao and Edwards (2020) also found early warning alerts useful for identifying new product development and their meaningfulness, and Lee and Lee (2017) who used patent and trademark data as early warning about competitors' technology development. Other studies also alluded to the use of early warning alerts to assist them in managing disruptive innovation (Veugelers, Bury and Viaene, 2010; Paap and Katz 2004).

Table 9 Communications and innovation. *Correlation is significant at the 0.05 level (2-tailed). **Correlation is significant at the 0.01 level (2-tailed).

Communications question	Correlation with innovation
Communications depth	.184**
Warning Alerts	.205**
Presentations / Staff Briefings	.164**
Teleconference	.155*
Central Database	0.117
Printed Alerts or Reports	0.072
Company Intranet	0.045
Personal Delivery	0.044
Newsletters	0.025
E-mails	-0.024

4.7 CI management/evaluation and performance

Respondents were given 13 CI evaluation/performance measures and asked which ones were used by their organization. A composite total number of performance measures was calculated by adding up all measures used for a fourteenth measure. Of the fourteen measures, twelve had statistically significant correlations with innovation (Table 10). Use of multiple measures had the strongest correlation with innovation, while not having any performance measures had a strong negative association with innovation (0.308). This was one the four largest correlation in the study and would suggest that

it is important to have some effectiveness measures of CI activities for innovation. Consistent with the results reported in this paper, those measures associated with the longer term, customers and technology were the ones most associated with innovations such as new products or services, strategies enhanced and customer satisfaction.

Table 10 CI management/evaluation and innovation.
*Correlation is significant at the 0.05 level (2-tailed).
**Correlation is significant at the 0.01 level (2-tailed).

CI performance measure used	Correlation with innovation
Total number of performance measures	.322**
We have no effectiveness or value measures	-.308**
New Products or services	.244**
Strategies enhanced	.222**
Customer satisfaction	.213**
Profit increases	.213**
CI productivity output	.202**
New or increased revenue	.175**
Decisions made supported	.160*
Cost savings or avoidance	.153*
Return on CI investment	.151*
Financial goals met	.140*
Time savings	0.095

5. CONCLUSIONS AND AREAS FOR FUTURE RESEARCH

This study found a significant relationship between 59% of the study's CI variables and innovation with the strongest correlations being in CI organization variables, CI management variables, CI focus and planning variables and innovation. Using a more comprehensive measurement of CI (95 variables) that looks at the many areas of intelligence enables the field to better understand not just whether CI is related to innovation but specifically what aspects of CI are related to it. For example, when the question is asked "do you do formal analysis?", the relationship between that and CI is not significant, but the type of techniques used are significantly related to innovation. Breaking down planning and focus into different foci, different products and different temporal orientations similarly provides insights for innovation. For example, the study noted that temporal orientations of less than one year were negatively correlated with innovation while orientations on projects of longer than 10 years were positively correlated with innovation. This does not mean that organizations should not have short term intelligence topics, but it does mean that they need to spend time in longer-term intelligence projects as well.

In summary, the approach taken in this study has found significant relationships between various CI process and structure variables and innovation and provided insights into what elements of the CI process and structure are most related to innovation.

However, as acknowledged in the methodology section, only one measure was used for innovation. Given the significant relationships found in this study, future studies should be encouraged that will use more innovation measures. There is a lot of innovation measurement literature that should be consulted to help with this. One example of this would be the OECD's book measuring innovation (OECD 2010).

Future studies should also look at using causal statistical approaches to look not just for a relationship between CI and innovation but to look at the extent to which CI practices cause and explain innovation performance.

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