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Drivers for Innovation in Small and Medium-Sized Enterprises

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Abstract: Innovation is the foundation for sustaining competitive advantage and growth. Innovation management is vital to small businesses, and requires clear plans, processes, and measures. This study examines key drives of innovation in small- and medium-sized enterprises (SMEs). Based on an extensive literature review, a set of eight constructs pertaining to innovation practices were identified. Each construct was assigned six codes, which were validated by analysing application summaries of the Baldrige Award recipients. Content analysis of 880 publications revealed their relevance and relative importance. Principal components analysis (PCA) suggested that "idea generation" and "marketing capabilities" are two key drivers for innovation. This paper represents a detailed description of the steps followed and the results obtained. The paper concludes with practical implications and proposes directions for future research.

Keywords: *drivers for innovation, innovation models, small and medium sized enterprises, qualitative analysis, principal components analysis, content validity ratio.*

Introduction

Despite the fact that the United States (US) is known for large corporations (Liu et al 2012), it has over 28 million small businesses, representing the majority of all employers nationally (Office of Advocacy of the U.S, 2015). Vyas (2014) argued that over the past 50 years, research has consistently shown a connection between innovation and business success. This paper represents research efforts made to identify drivers of innovation in small business. According to Jones and Tilley (2003), the definitions of a small business in the U.S. and Europe are entirely different. A firm in Europe is referred to as "small" if it has less than 50 employees, whereas in the U.S., a firm is referred to as "small" if it employs less than 500 people. In this paper, the term small business is used to include small- and medium-sized enterprises (SMEs). The research methodology utilized computer-aided text analysis (CATA) and multivariate techniques to determine the key drivers of innovation as represented in scholarly publications. Contents of 880 peer-reviewed, full text publications were analysed. This study presents a literature review of definitions, types, and constructs used to model innovation practices. In addition, there is a discussion of the research methodology and the steps followed for data collection and analysis. A discussion of the results obtained with validation remarks are represented. Conclusions and recommended directions for future research are presented at the end of this study.

Literature Review

The objective of this literature review was to identify studies related to factors that drive innovation success in the small business sector. The review attempts to identify innovation potentials from a broad-spectrum of innovation practices and dimensions. Hence, the literature review discusses various definitions of innovation, types of innovation, and innovation models and practices.There is a plethora of "innovation" definitions by researchers, practitioners, and policy makers. The United Kingdom's National Endowment for Science, Technology and the Arts (NESTA) defined innovation as "change associated with the creation and adaptation of

ideas that are new-to-world, new-to-nation/region, new-to-industry, or new-to-firm" (Patterson et al., 2009, p. 5)." The Organization for Economic Co-operation and Development (OECD), defined innovation as "the implementation of a new or significantly improved product, or process, a new marketing method, or a new organizational method in business practices, workplace organization or external relations" (2005, p. 46). Also, the Baldrige Performance Excellence Program (2015) indicated that "innovation means making meaningful change to improve organization's products, services, programs, processes, operations, and business model, with the purpose of creating new value for stakeholders" (p. 42).

According to the OECD (2005), there are four main types of innovation: product, process, marketing, and organizational innovation. Product innovations involve the introduction of goods or services that are new or significantly improved with respect to their characteristics or intended uses. This includes significant improvements in technical specifications, components and materials, incorporated software, user friendliness, or other functional characteristics. Process innovations involve the adoption of new or significantly improved production or delivery methods. These require significant changes in techniques, equipment, and/or software. Marketing innovations target the implementation of new marketing methods. In contrast, organizational innovations require implementation of new organizational methods in a firm's business practices, workplace organization, or external relations. The emphasis is placed on the process involved in product innovation, where the term "product" is used to cover both goods and services, as defined by the OECD (2005).

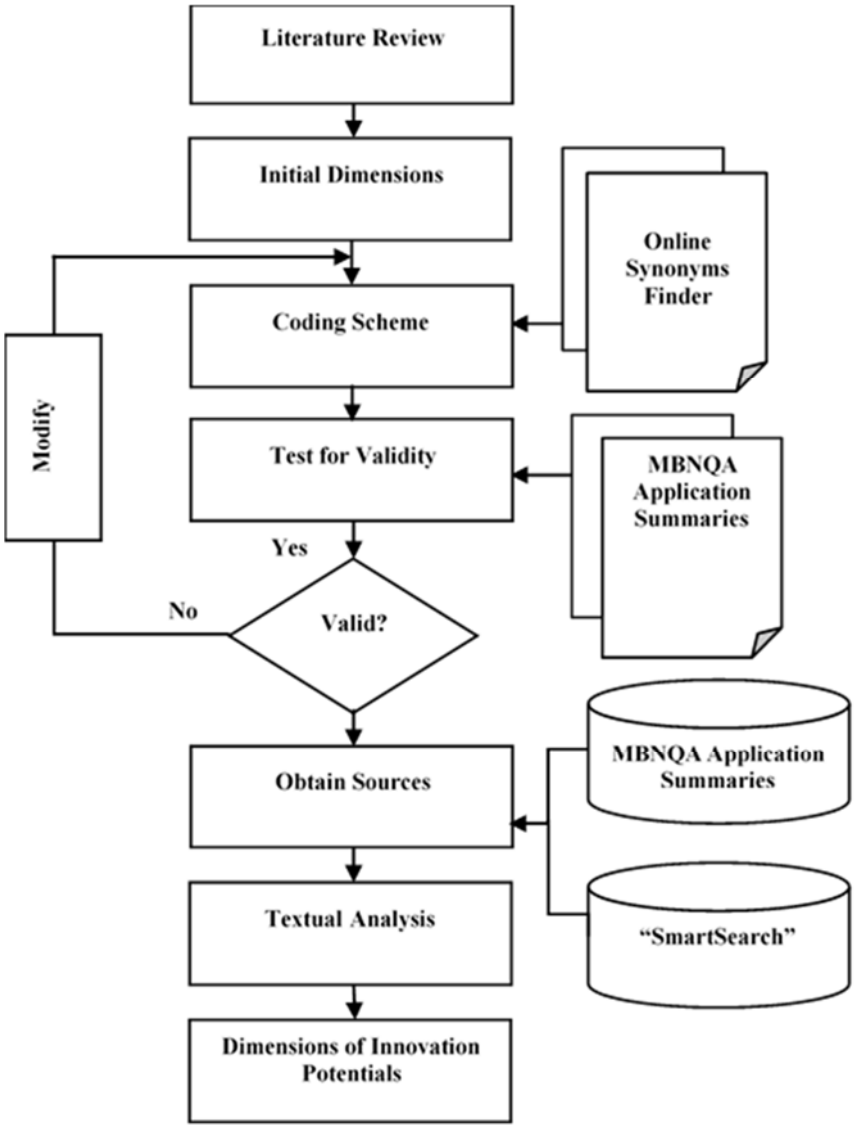
Several innovation models and constructs from the literature were studied and analysed in this research. Corona-Armentats et al. (2007) studied technological innovation within the manufacturing sector. They proposed a model for measuring innovative capacities. The model contained thirteen practices: conception, follow-up, integrated strategy, and portfolio management, among others. Hogan and Coote (2014) identified dimensions of organizational culture that support innovation. They examined the values, norms, and artefacts that the literature suggests motivate innovative behaviours. Accordingly, they identified a number of factors that can be utilized in achieving an innovation-oriented culture. The factors consisted of success, openness and flexibility, internal communication, competence and professionalism, inter-functional cooperation, responsibility of employees, appreciation of employees, and risk-taking. Rahman et al. (2015) proposed a model for measuring innovation capabilities called Sustainability of Overall Innovation Capability (SUSTINOVAT). They put forward an eight-dimensional (8D) scale for evaluating innovation activities. The eight dimensions included: strategic management, supportive culture and structure, resource allocation, communication and networking, knowledge and technology management, idea management, project development, and commercialization capabilities.

According to the National Institute of Standards and Technology (NIST 2014), the Baldrige Award is the highest level of national recognition for performance excellence that a U.S. organization can receive. The award was named after Malcolm Baldrige, who served as Secretary of Commerce in 1981. The award holds major consequence in the U.S. as it improves the quality and productivity of businesses. The NIST's website contains a list of 15 small business award recipients from 1999 to 2015 with complete application summaries (www.nist.gov/baldrige). These applications highlight best managerial practices for setting and achieving business results.

Methodology

Research efforts utilized computer text analysis of articles in the English language published in peer-reviewed journals over the last 16 years. The research was motivated by the work of Usrey and Dooley (1996) in identifying dimensions of software quality. Content analysis was utilized as the fundamental method for analysing published papers related to innovation in SMEs. Onwuegbuzie et al. (2012) indicated that content analysis consists of "systematically reducing sources to codes deductively or inductively, then counting the number of codes" (p. 12). Content analysis was conducted using NVivo 10, a qualitative data analysis software. Results were statistically analyse by utilizing Statgraphics® (2009). The research methodology is illustrated in Figure 1. Detailed description of the steps taken is represented in the following section.

Figure 1: Manifest Construct Analysis



Initial Constructs

The first step of the methodology involved the identification of initial constructs. A total of 35 constructs was initially identified based on the research cited in this study. However, these constructs had some duplications. For instance, the construct "capitalization of knowledge" by Corona-Armentats et al. (2007) was considered to be a duplicate of "knowledge and technology management" as proposed by Rahman et al. (2015). Another issue in identifying the constructs

was to replace the phrases used to describe constructs with single words. This was necessary to facilitate coding. As an example, "knowledge and technology management" was reduced to "knowledge" as the construct and "technology" was added as a code for representing "knowledge." These steps were applied to all constructs. The final set of constructs was more relevant to what Rahman et al. (2015) proposed than the other models. The final constructs are: commercialization, communication, creativity, development, environment, knowledge, management, and resources. Appendix A shows the set of constructs along with their definitions.

Coding Scheme

This step comprised assigning codes (symbols) for each of the eight constructs. This coding scheme represented the foundation for content analysis. The synonyms finder (http://www.thesaurus.com), was utilized to generate codes. In addition, adjectives within the definitions of each constructs were added. For instance, the definition of the construct "creativity" had the words generate, original, and idea which were included as codes. This resulted in a different number of codes representing each construct. There were between six and thirteen codes per construct.

Validation of Codes

The codes from the previous step were validated by following the procedures proposed by Lawshe (1975). He suggested using the content validity ratio (CVR) to measure the level of agreement among experts (panellists). The ratio is calculated as:

$$CVR=ne-(N/2)/(N/2) \qquad (1)$$

Where *ne* represents the number of panellists indicating that the code is a valid representation of the construct, and N is the total number of panellists. In this application, validation was based on textual analysis of 15 application summaries of the Baldrige Award recipients in small business. Each application summary was considered as an input form one expert and was used to validate the codes. All of the 15 applications were downloaded from the NIST's website and uploaded to NVivo. A text search query for each code was conducted. The codes and their stem words were searched in a separate query to obtain the frequency of their occurrence within each application. The results were exported to an excel file. A value of 1 was assigned to the code when it appeared within the application and 0 otherwise. The CVR for each code was calculated accordingly. As it was pointed out by Lawshe (1975), for 15 experts (applications) a minimum CVR of 0.49 is required at the 95% confidence level. Only those codes with CVR values meeting this minimum threshold were retained. An example of codes representing the creativity construct for each small business's application is shown in Table 1.

Table 1: Creativity Codes Agreements and CVR

Code	SB 1	SB 2	SB 3	SB 4	SB 5	SB 6	SB 7	SB 8	SB 9	SB 10	SB 11	SB 12	SB 13	SB 14	SB 15	Agree	CVR
Conception	1	1	1	1	1	1	0	1	1	1	1	0	1	1	1	13	**0.73**
Creative	0	0	1	1	1	0	1	0	1	1	1	1	1	1	0	10	**0.33**
Design	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	15	**1.00**
Generation	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	15	**1.00**
Innovativeness	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	15	**1.00**
Originality	0	1	1	1	1	1	1	1	0	1	1	1	0	1	1	12	**0.60**

To avoid bias, the number of codes per construct was set at five (in addition to the construct). Appendix B shows the final set of dimensions and codes. In cases where more than five codes were identified, the total frequency of their occurrence was considered. This is shown in Table 2 for codes representing the development construct.

Table 2: Development Codes Frequency

Code	SB 1	SB 2	SB 3	SB 4	SB 5	SB 6	SB 7	SB 8	SB 9	SB 10	SB 11	SB 12	SB 13	SB 14	SB 15	Freq.
Advancement	6	1	1	6	13	6	18	4	4	0	5	7	4	4	2	**81**
Development	112	120	183	122	165	100	121	128	100	11	112	56	57	66	48	**1501**
Expansion	1	4	4	4	3	8	1	3	8	0	6	6	1	9	0	**58**
Improvement	203	145	189	156	179	205	114	146	143	12	216	155	148	95	68	**2174**
Increase	43	30	40	4	42	36	15	31	35	3	45	18	8	27	13	**390**
Progression	15	9	8	14	34	35	14	21	23	3	11	24	12	10	8	**241**

Publications Selection

This step involved selecting research publications related to innovation in small business. A search was conducted by accessing a scholarly search engine through the University library and utilizing SmartSearch engine. Several databases were searched including: Business Source Complete, Academic OneFile, Expanded Academic ASAP, General OneFile, ScienceDirect, Business Insights: Essentials, and JSTOR Journals. The search query included "innovation," in the publication title, and the terms "small business," "SMEs" and their derivatives in the abstract. Also, the terms "factors," "model," "framework," "dimensions," or "constructs" had to be present in the publication text. The full Boolean string used is shown in Figure 2.

Figure 2: The Boolean String Used for Publication Search

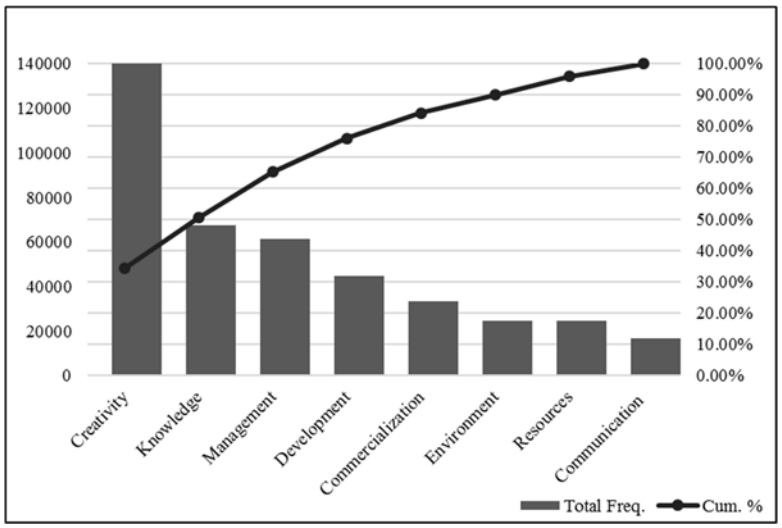
> *TI Innovat* AND TX (construct* OR framework* OR model* OR dimension*) AND AB ("small business*" OR "SME*" OR "small firm*" OR "small enterprise*" OR "small and medium sized enterprises" OR "small to mid-sized organization*" OR "small-medium sized organization*" OR "small to mid-sized organisation*" "small organization*" OR "small organisation*" OR SMB* OR "Small-to-Medium Business*" OR "small company*"*

The search was limited to full-text, peer-reviewed publications in English that were published in the last 16 years. Search results yielded 1,200 publications. These were examined by following the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) guidelines in order to determine their relevance to the research (Moher et al., 2009). The PRISMA flow chart is shown in Appendix C. This resulted in identifying 880 publications, all of which were available in the portable file format (PDF).

Date Analysis

All publications were uploaded into the NVivo software and a word frequency query was performed. A Pareto chart of the resulting counts is shown in Figure 3. The chart indicates that creativity, knowledge, management development, and commercialization accounted for 84% of the total frequency. Creativity is the most frequent construct used within the publications contributing 34.4% to the total count, followed by Knowledge with 16.2%. Communication appears to have the lowest frequency contributing only 4.0% of the total.

Figure 3: Pareto Chart



In an effort to gain better understanding of the relationships between the constructs, principal components analysis (PCA) was performed. PCA is a "multivariate technique in which a number of related variables are transformed to a smaller set of uncorrelated variables" (Jackson, 2005, p. xv). In contrast to factor analysis, PCA does not involve specific assumptions regarding the relationships between variables, and does not discriminate between shared and unique variances. PCA uses the frequencies obtained from textual analysis to identify strong patterns in the data and possibly decrease the total number of constructs.

Results from textual analysis were used to generate an 880 x 8 matrix. Values within each cell represented the frequency of occurrence of each construct (and its codes) within each publication. The matrix was used as the input for the PCA function in the Statgraphics® software. The analysis reported a Kaiser-Meyer-Olsen (KMO) measure of 0.76, indicating that some common components can be extracted. Results of the PCA are illustrated in Table 3. The Kaiser-Guttman rule, which is the most popular stopping criterion for PCA, was used to perform the analysis (Kaiser, 1960). The criterion requires that components linked with eigenvalues greater than 1.0 are considered nontrivial. As can be seen, the first two principal components were over the eigenvalue threshold of 1.0. Hence, these two principal components (PCs) have been extracted.

Table 3: Eigenvalues of Components

Component	Eigenvalue	Percentage of Variance	Cumulative Percentage
1	**2.41**	**30.10**	**30.10**
2	**1.06**	**13.30**	**43.40**
3	0.95	11.90	55.40
4	0.88	11.0	66.40
5	0.77	9.70	76.10
6	0.70	8.80	84.80
7	0.67	8.50	93.30
8	0.53	6.70	100.00

Table 4 illustrates the eigenvector coefficient (weight) of each of the eight constructs relative to each component. As pointed out by Legendre and Legendre (2012), a positive value of

weight indicates a positive correlation between the construct and the principle component. Similarly, negative values indicate negative correlations. Also, constructs with eigenvector coefficients with absolute values greater than 0.25 were considered as major contributors to each component. As shown in Table 4, creativity, management, development, environment, and resources made significant contributions to the first component (PC1). In addition, knowledge, commercialization, and communication made significant contributions to PC2.

Table 4: Principal Components and Eigenvector Coefficients

Dimension	PC1	PC2
Creativity	**0.406**	0.166
Knowledge	0.326	**-0.534**
Management	**0.449**	0.154
Development	**0.398**	-0.020
Commercialization	0.204	**0.643**
Environment	**0.360**	0.188
Resources	**0.298**	-0.004
Communication	0.330	**-0.463**

Results and Discussion

Results from the content analysis of the 880 publications indicated the frequency of occurrence of each construct and its codes. A Pareto analysis of the tally indicated that creativity, knowledge, management, development, and commercialization account for the majority of total. These constructs appear to derive innovations in SME's as represented in published research. The fact that these constructs have been addressed the most among researchers attests to their relevance. Relative frequencies may be used as measures of their relative importance. However, it should be noted here that this does not mean that these are the only constructs representing innovation in SME's. Some important constructs may have received no or limited attention from researchers. These should be viewed as the minimum number of constructs that can be used to represent innovation. Results from the principal components analysis suggest two key drivers (meta-dimensions) as shown in Table 5.

Table 5: Key Drivers of Innovation

Idea Generation (PC1)	Marketing Capabilities (PC2)
Management	Commercialization
Creativity	Knowledge
Development	Communication
Environment	
Resources	

They were found to explain 43% of the variability in the count. The first (PC1) included management, creativity, development, and resources. These constructs contributed 72% of the

total count. Taken together, they suggested a key driver of "idea generation" as it relates to internal capabilities of the enterprise and its management team. The contrast "management" has the highest contribution to "Idea Generation," which agrees with Rahman et al. (2015). However, Rahman et al. (2015) assigned creativity the seventh rank among the eight dimensions. This is supported by Poorkavoos et al. (2016), who argued that certain internal capabilities are vital because they stimulate innovation. Management is proven to be a vital component of idea generation, which is supported by Al-Ansari et al. (2014, p. 6), who stated that "management appears to play an important role in determining and supporting the firm's decision to adopt and/or generate innovations regardless of its size". In addition, they asserted that "a supportive culture can further drive value creation and encourage innovative ways of representing problems and searching for solutions" (p. 6).

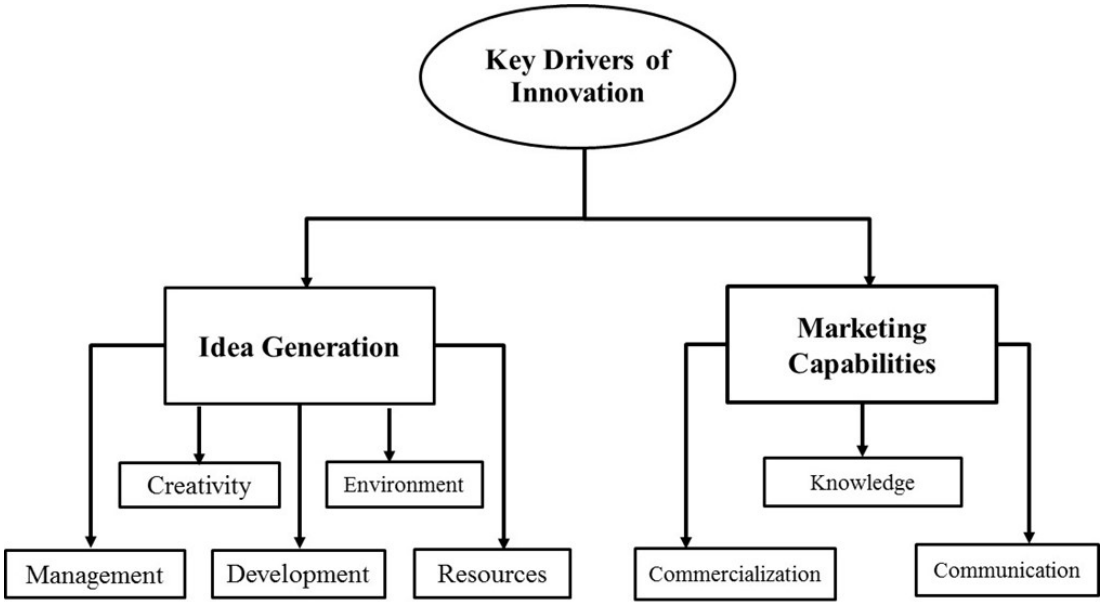
On the other hand, the second principal component (PC2) included commercialization, knowledge, and communication constructs. Taken together, these three constructs accounted for 28% of the total count. This second component suggested "marketing capabilities" as another key driver for innovation. This drive refers to the ability of the enterprise to market new products. This is supported by Biazzo, et al. (2013), who discussed a similar component, referred to as "market intelligence" and defined it as "activities that analyse the demand and supply, and the environment in which these are embedded" (p. 89).They added that, after all, the purpose of market intelligence is to acquire the necessary knowledge of market segments, customer motivations, and competitor performance. Also, the literature supports the idea that knowledge is an integral part of the marketing capabilities. As was pointed out by Evangelista et al. (1998, p. 18), "the knowledge of the market is part of the overall strategic innovation process".

Conclusion and Future Research

This research was aimed at identifying key drivers of innovation in an effort to help small businesses improve their innovation processes. Eight constructs were identified from the literature. These are: management, development, knowledge, communication, commercialization, resources, environment, and creativity. The research started by identifying appropriate codes that can be used to represent each. The codes were validated based on 15 application summaries from recipients of the Baldrige Award. Resulting codes were used to perform content analysis of 880 scholarly publications. To assure repeatability of the results, publication selection was performed by following the PRISMA guidelines. Based on results of the textual analysis it can be concluded that innovation potentials in SMEs can be determined based on the eight constructs considered. While these constructs are not claimed to be comprehensive, they should be viewed as the minimum number of constructs required to evaluate innovation in small- and medium-sized firms.

In addition, results of the principle component analysis suggested two key drivers of innovation (meta-dimensions) that appear to dominate perceptions of innovation from the viewpoint of researchers. These were termed "idea generation" and "marketing capabilities" as shown in Figure 4.

Figure 4. Drivers of Innovation



The authors propose the following definition for each:

Idea Generation: refers to management's ability to create a supportive environment and provide sufficient resources to assist in the development of creative ideas into new products and processes.

Marketing Capabilities: refers to the abilities of organizations to commercialize and market new products based on knowledge of market trends and communication with their stakeholders.

This research indicated that Creativity is the second most important dimension for innovation potential. The results presented in this paper offer a foundation for developing methodologies for evaluating innovation processes and quantifying the risks involved in new projects. It is recommended that SMEs develop two different measures to evaluate their performance relative to the two key drivers. Separate assessments would help identify the firm's weaknesses and guide managerial actions. These authors are in the process of developing instruments that can be customized for and used by different firms to evaluate their performance. Similar to Baldrige self-assessment tools, such instruments may provide ways to evaluate activities and determine how well an organization is meeting its innovation goals and objectives.

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Appendix

Appendix A. *Innovation Dimension's Definitions in Small Business*

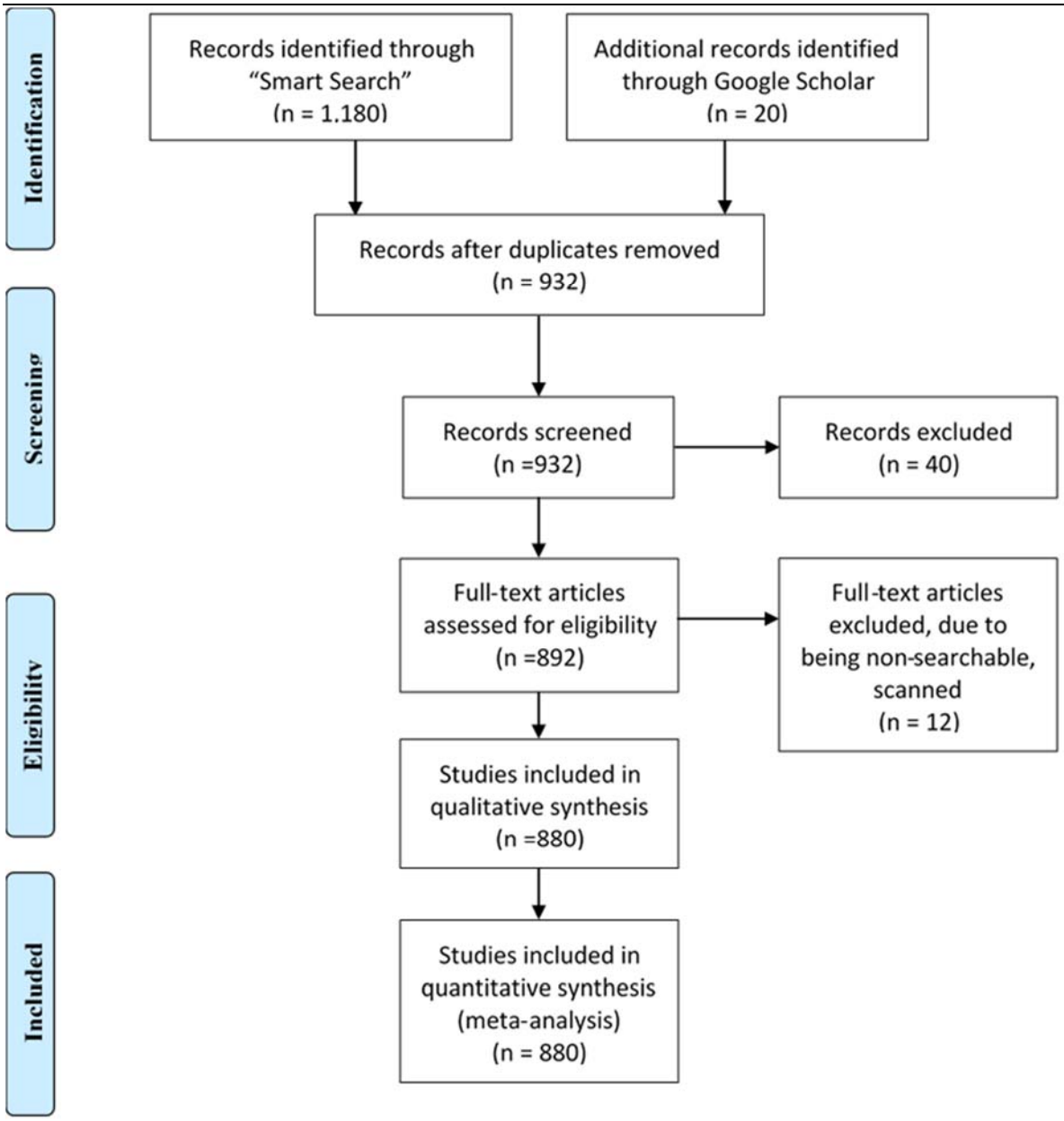
Dimensions	Definitions
Commercialization	Converting ideas and new innovations into new marketable products (Azimi et al., 2013)
Communication	A symbolic interaction between organizations and their stakeholders dealing with new products, services, technologies, and ideas (Mast, 2011)
Creativity	Generating new and entirely original ideas (Patterson et al., 2009)
Development	Systematic applications of knowledge or understanding directed toward the production of useful materials, devices, and systems or methods to meet specific requirements (National Science Board, 2010)
Environment	The total surroundings, which have a direct or indirect bearing on the functioning of business or a set of external factors (Radomska, 2010)
Knowledge	Information combined with experience, context, interpretation and reflection (Davenport et al., 1998)
Management	Coordinated activities to direct and control an organization (Kostogryzov, et al., 2012)
Resources	Refers to human, financial, physical, and slack assets (Rahman et al., 2015)

Appendix B. *Final Set of Dimensions and Codes*

Dimension	Code	Dimension	Code

Commercialization	Market Profit Distribute Capitalize Execution Commercialize	Environment	Environment Culture Integrate Responsible Structure Flexible
Communication	Communicating Reporting Feedback Contacting Discussing Interacting	Knowledge	Information Knowledge Technology Education Experience Reflection
Creativity	Design Innovativeness Conception Generation Originality Creative	Management	Manage Support Strategy Direct Vision Administration
Development	Improvement Development Increase Progression Advancement Expansion	Resources	Resource Staff Revenue Equipment Supplies Capital

Appendix C. *PRISMA Flow Diagram*


Identification
Screening
Eligibility
Included
Records identified through "Smart Search" (n = 1.180)
Additional records identified through Google Scholar (n = 20)
Records after duplicates removed (n = 932)
Records screened (n =932)
Records excluded (n = 40)
Full-text articles assessed for eligibility (n =892)
Full-text articles excluded, due to being non-searchable, scanned (n = 12)
Studies included in qualitative synthesis (n =880)
Studies included in quantitative synthesis (meta-analysis) (n = 880)