

# Improving Entrepreneurial Opportunity Recognition through Web Content Analytics

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**Abstract**—The ability to recognize and develop an opportunity into a venture defines an entrepreneur. Factors such as prior knowledge, cognitive and creative capabilities are shown to affect opportunity recognition in entrepreneurs. Research also shows that experienced entrepreneurs search and scan for information to discover opportunities. Searching and scanning for information mediate the effect of prior knowledge on novice entrepreneurs and enable them to better identify and recognize opportunities even when lacking knowledge and experience. There is less focus in research on finding empirically proven techniques and methods to develop and enhance opportunity recognition in student entrepreneurs. The lack of knowledge has been linked to more likelihood of business failures. This study aims to develop a model for opportunity recognition by using web content mining for student entrepreneurs to better identify and recognize business opportunities. The model will be evaluated through qualitative and quantitative methods. A prototype of the model is planned to be built to evaluate the efficacy and usefulness of the model. This model is expected to enable graduate entrepreneurs to generate more business ideas that are more innovative and viable.

**Index Terms**—Entrepreneurship; Opportunity Recognition; Web Analytics; Web Content Mining.

## I. INTRODUCTION

The various literature has expounded on the contribution of entrepreneurship to a country's economic growth through innovation, job and wealth creation, and individual and societal growth [1][2][3]. Encouraging entrepreneurship has always been one of the focus agendas of the Malaysian government with billions of dollars allocated in the yearly national budget to support the growth of entrepreneurs in the country. A budget of RM170 million is allocated in the 2016 budget for growing young entrepreneurs [1] and an additional RM25 million is allocated for graduate entrepreneurs in the 9<sup>th</sup> Malaysian Plan.

The Malaysian Education Blueprint for Higher Education 2015-2025, also focuses on developing entrepreneurial graduates in the first shift of the blueprint. To develop graduate entrepreneurs (defined as students who have graduated and become entrepreneurs), various schemes are introduced and one of them is the implementation of entrepreneurship programs in universities and colleges in Malaysia [2]. These programs need to be able to develop the students to be innovative, creative and opportunistic. Entrepreneurs must first seek and be able to identify value-generating opportunities in the form of a business idea before evaluating it and developing it into products or services in an income-generating enterprise [4]. Therefore, supporting the growth and developing the capabilities of student entrepreneurs are important; not just for the individuals, but

also for the institutions and to a small extent the country.

## II. MOTIVATION

What separates an entrepreneur from a manager or an employee is the ability to identify opportunities and grabbing these opportunities and realising business ventures around them [5]. Shane and Venkataraman [6] define entrepreneurship as “a field that studies sources of opportunities, process of discovery, evaluation, and exploitation of opportunities, and the set of individuals to discover, evaluate, and exploit them.” Being able to identify opportunity is essential for an entrepreneur and its the first step in being an entrepreneur.

The probability of business failure increases if an individual is “forced” to become entrepreneurs out of necessity such as unemployment [42]. Those who actually want to become entrepreneurs and start their venture out of opportunity discovery or creation are more likely to survive as entrepreneurs. With the Malaysian government encouraging student entrepreneurs (defined as those yet to graduate and are potential entrepreneurs) to develop new business ventures once they graduate, it is, therefore, better to have them be driven by opportunities than necessity. These student entrepreneurs need to be pulled into business creation based on their own identified opportunities. This can lead to a better probability of business survival. Hence, there is a need to develop a method to improve opportunity recognition that can result in a viable business idea (defined as a venture that can grow and be successful) for these entrepreneurs.

Although the importance of opportunity recognition is acknowledged by researchers [6] and [13], there has been little focus on finding proven techniques and methods to develop and enhance this ability in student entrepreneurs. A search of the literature revealed few examples with empirical findings. DeTienne and Chandler [7] enhance students' business opportunities idea generation to be more innovative by applying the SEEC model (securing, expanding, exposing, and challenging). Students were told to record, organize, share, brainstorm, problem solve in their daily lives, individually and in groups over a period of time. More recent examples show that training students in creativity exercises [8] and problem-solving processes with convergent and divergent thinking styles [9] enable students to identify more business ideas that are also more innovative.

Other researchers have proposed through investigation of opportunity processes, methods to enhance opportunity recognition in entrepreneurs though almost all are conceptual and not empirically proven. For example, a research [10] proposes a two-pronged approach model to enhance opportunity recognition in students. Firstly, students are involved in classroom exercises such as pattern recognition,

categorization. Secondly, students are exposed to real-life experiences in the industry.

Hence, there is a perceived gap in the body of knowledge of enhancing opportunity recognition in entrepreneurs. First, there is a lack of actual models of enhancing opportunity recognition, only methods are proposed and some tested. Secondly, there is a lack of empirical evidence to determine what techniques and methods fit which conditions and situations to enhance opportunity recognition, especially in student entrepreneurs. Thirdly, the methods mostly involve tweaking the curricula of entrepreneurial education. A possible technological solution such as using web mining to enhance opportunity recognition in entrepreneurs is less researched. Although an IT solution initially can be expansive, it is an attractive alternative solution due to easier sustainability and proliferation and can be quick and easy for users to use.

This paper, therefore, aims to investigate whether opportunity recognition in student entrepreneurs can be enhanced through a technological solution using web content mining. A design research approach is applied where theory drives the creation of artifacts (e.g. models, prototypes) that can solve an identified problem, and the findings from the artifacts creation are then applied back to improve theories in that field [43]. The artifacts are built and evaluated for efficacy and efficiency in solving the problems [44].

### III. ENTREPRENEURIAL OPPORTUNITY RECOGNITION

#### A. Defining Opportunity Recognition

The Opportunity is defined as “perceived means of generating economic value (i.e. profit) that have not been exploited, and are not currently being exploited by others” [12]. The author of the work [12] defines opportunity recognition as “the cognitive process (or processes) through which individuals conclude that they have identified an opportunity.” Others such as [13] define opportunity recognition as the process of perceiving the needs and gaps in resources in the market, and subsequently discovering, and creating suitable solutions for them and [14] defines it as “opportunities to bring into existence new goods, services, raw materials, and organizing methods that allow outputs to be sold at more than their cost of production”. From the definitions, it can be seen that some researchers emphasize the cognitive processes of opportunity recognition while others the knowledge and gaps in the market, customers, and resources.

Opportunity has also been divided into three types [16]. He states that opportunity can be replication, demand and supply-driven. Franchisers are a good example of replication-driven opportunities where the demand and supply already exist while demand-driven opportunity such as organic food industry is identified by the demand for a healthier option. Changes in technology usually create supply-driven opportunities such as the introduction of the smart-phone which created a whole ecosystem in the industry. The authors Saravathy [16] and Ge [17] instead labelled these opportunities as recognition or identification (replication), discovery (demand-driven) and creation (supply-driven) type of opportunities.

Whether opportunities are identified, discovered or created, the ability to recognize and develop an opportunity into a viable business that creates value are important characteristics of an entrepreneur. This entrepreneurial ability

has two main components. First is to identify a feasible and viable business opportunity and second, to develop this opportunity to fruition. Identifying opportunity is just the first step with many iterations of the business idea occurring during the process of developing the business as it goes through various cycles of evaluation and evolution [13].

#### B. Prior Knowledge in Opportunity Recognition

The Individual differences observed in the ability to identify and recognize opportunity has been explained in various ways such as capability for bisociative thinking [18], cognitive ability to “connect the dots” [12], learning [15], social networks [40], prior knowledge [18], self-efficacy [41]. In works [13], propose that alertness, information asymmetry and prior knowledge, social networks, personality traits, the type of opportunity, and level of search are the key factors in successful opportunity recognition and development. Three factors identified as more important in opportunity recognition: actively searching for opportunities, being alert to opportunities, and prior knowledge of market, industry or customers [13]. Prior knowledge is defined as all the accumulated knowledge and experience that an individual has [10]. Failure to have information and having little or basic comprehensive knowledge of the business opportunity leads to poor performance on new ventures [37].

Business ideas do not pop out of thin air. Something cannot be created from nothing and this includes business ideas in entrepreneurs [39]. Many researchers over the decades have highlighted the role of information and knowledge in influencing the ability to recognize opportunities [6][13][18-20][22]. This is because cognitive psychologists have shown that people's prior knowledge affects how they perceive their environment and what they pay attention to consciously or subconsciously in their environment. New knowledge is perceived, organized, interpreted, and remembered based on prior knowledge. Absorptive capacity that is the ability to “recognize the value of new information, assimilate it, and apply it to commercial ends” is increased with having relevant prior knowledge [23]. It acts as the foundation for entrepreneurs to search, be alert, organize, manage, interpret, and understand their environment, and leads to more opportunity identification. Therefore, prior knowledge plays an important role in being able to identify the value of new information and consequently opportunities are recognized.

There are three types of knowledge deemed important for opportunity recognition. They are prior-knowledge in markets, way to serve the markets, and customer problems [6], [13], [19]. Their findings also show that prior-knowledge is especially important for high-technology entrepreneurs. An entrepreneur's technical knowledge is also important for opportunity recognition [24]. Shepherd and DeTienne [20] show that knowledge of customer problems resulted in the participants recognizing more opportunities that are also more innovative. The knowledge of the whole environment is important such as changes in the economy, consumer market, industry, technology, and much more [12]. Therefore, knowledge on various dimensions such as the market, the products and services, technological changes, the competition, the customers, and much more are important.

The majority of Malaysian graduates' path to entrepreneurship starts after having some work experience and not while they are still students or immediately after graduating [21]. As quoted in [10], in a survey, most student entrepreneurs although have a high intention for

entrepreneurship, they do not have a business idea at the start of an entrepreneurial course, and few gain viable business ideas at the end. Real-world knowledge and experiences are necessary for developing entrepreneurs. Student entrepreneurs are, therefore, at a disadvantage with less knowledge and experience at their disposal to be able to identify opportunities and generate more business ideas.

### C. Active Search in Opportunity Recognition

From [11], it can deduce that there are two cognitive processes in entrepreneurial opportunity recognition. First, the entrepreneur sifts through the information and knowledge to find underlying patterns in them which are then matched in a second process to a cognitive prototype of an entrepreneurial opportunity. Individuals have cognitive frameworks representing their knowledge constructs of what an opportunity is in the form of prototypes and exemplars. These are unique in each individual. Prototypes are the idealized representation of the business opportunity while exemplars are specific representative examples of the opportunity concept stored in the memory of entrepreneurs [11]. The entrepreneurs define an opportunity, whether it's based on risks, certain profit threshold, self-efficacy, and any other thing that is specific to the entrepreneur, based on their opportunity prototype. The work [35] shows that there are distinct features in which business opportunity prototypes are based on such as: "solving customer's problem, ability to generate positive cash flow, manageable risk, the superiority of product/service, and potential to change the industry". "Viability and distinctiveness" are identified as two parameters of an opportunity recognition prototype and "feasibility and motivational factors" for the decision to start the business in nascent entrepreneurs [36]. Another study [37] proposes that an opportunity should have these dimensions: distinct offer to the customer, definite customer segment, unmistakable value, workable revenue model, and technological solutions.

A study [38] of novice, serial and portfolio entrepreneurs' shows that the number of opportunities identified by each category from highest to lowest in their study is a portfolio, serial, and then novice entrepreneurs. This can be explained using the prototypes and exemplars cognitive framework proposed by [11]. This implies that exposure to multiple examples of different businesses and different opportunities discovered by others may help student entrepreneurs by expanding their prototype and exemplars of opportunities and broadening their defined parameters of what an opportunity is. This may result in more opportunities discovered by the student entrepreneurs.

By using cognitive frameworks, people can discover patterns [12]. He [12] suggests that this ability to discern patterns from information is the underlying mechanism for opportunity recognition. Individuals are able to recognize the connection between seemingly unrelated events and changes in trends, events, and the general environment; the hidden pattern by "connecting all the dots". The perceived patterns then help entrepreneurs to identify opportunities. These patterns are perceived from changes in their environment such as the technology, economic, political, social, and demographic conditions.

A study [18] points out that making associations and connections are not sufficient for opportunity recognition especially where there is a need to be creative and innovative. Simple associations and connections link concepts and

knowledge in the same domain follow the path of least resistance, hence, resulting in a lack of novelty [39]. Bisociative thinking according to [18] is needed to allow entrepreneurs to combine and merge unrelated domains of knowledge and experience where previously no connections existed, resulting in more innovative ideas. More creative results can be obtained when two completely unrelated and opposing concepts are combined [39]. [39] Also calls out a paradox of knowledge where having too much knowledge can limit the creativity of a person. Others [8][22] show that using creative search strategies increases innovative ideas and training in creative processes [9] also show the same results. Providing stimuli to prompt student entrepreneurs to be more creative may help them be generated more innovative business ideas.

This paper suggests that developing an IT model, an information support system that efficiently gathers the needed information, effectively detect underlying patterns and prompts bisociative connections is the solution to help improve and enhance the ability of student entrepreneurs to better recognize opportunities and generate more business ideas. The ideas too are expected to be more viable and innovative. The core component of the model is web content mining.

## IV. WEB CONTENT MINING

A simple search on Google in June 2016, using the keyword "business idea" returns 45 million results and "business opportunities" returns 432 million results. This is a huge amount of data and information that is available to anyone at their fingertips. However, this is also the challenge of extracting any useful information from the web, the sheer magnitude and complexity of the information. In recent years, extracting relevant information from the web has become increasingly easier with advances in web mining algorithms, techniques, and applications. Web mining is the process of extracting useful information from the web using automated applications [34]. There are three categories of web mining: web content mining, web usage mining, and web structure mining [34]. The focus of this research is web content mining which is the process of extracting useful data, information, and knowledge from web page content. Web content mining can extract text, image, audio, and video content from the web from structured, semi-structured, and unstructured data-sets. Mining text content involves extracting content from documents, reviews, forums, emails, blogs, and forms. These are usually extracted into a database.

Organizations are beginning to extract information for innovation such as extracting customer reviews from the web for products and services provided [27] and innovation trends in companies [28]. Researchers have also applied web content mining to discover new knowledge such as commercialization process for small-medium sized companies from discovery to introducing the product in the market [29] and to extract and use the knowledge for other important things such as identifying and mapping geohazards [30]. As the content which is available on the web is so diversified and on almost every subject imaginable, the information is extracted for more and more variety of applications for individual, researchers, organizations, and even governments. Some examples of how web mining is increasingly playing several roles in business opportunities are:

- creation of aggregator and comparison sites that takes advantage of information asymmetries in the market
- retrieving information on the web for market research and competitive intelligence with knowledge of how competitor is packaging and offering their products and services
- retrieving and analyzing customer reviews, comments, complaints and spending patterns to discover valued product and services features and functionalities and what need to be improved
- analysis of patents gives a broad overview of the industry research direction and trends, and to some extent the competitions' R&D directions

Sharma and Gupta (2012) divided the tasks into 4 adapted from the Knowledge Discovery from Database process (Fayyad, 1996):

- Information retrieval, where the target data is searched for, retrieved and extracted from documents, web pages, and website on the web.
- Pre-processing, where the target data is processed for the desired representation
- Pattern recognition, where the patterns in the information is detected
- Analysis, where the patterns are analyzed, interpreted and validated for useful insights

This paper posits that the web is a very rich repository of knowledge that can be utilized for the benefit of student entrepreneurs. These entrepreneurs are in need of real-world knowledge in a variety of fields and industries depending on their business interests, with a need to understand the current market and the current and possible future needs of potential customers. The information mined will focus on information that can help to enhance this ability in the student entrepreneurs. An information support system with web content mining geared towards this may be the right solution for student entrepreneurs.

Web content mining tools can handle both data extraction/retrieval and exploratory data analytics as part of its analysis function. The focus of this research is descriptive analytics. Descriptive analytics is more focused towards historical data and gives a bird's eye view of the overall data and is usually applied in data mining. It's exploratory in nature and the goal is to discover patterns and insights. Methods that are commonly used include clustering and association rules. Analytics functions similar to [12] cognitive function of opportunity recognition where entrepreneurs are expected to find patterns and link different information together to find meaning and insight into possible business opportunities. An additional component to provide the stimuli for creative associations and connections is also part of the solution. This entails providing random information extracted from the web to enable the student entrepreneurs to make more creative and innovative associations and connections [39].

## V. PROPOSED SOLUTION

Opportunity recognition depends on the knowledge, pattern recognition, creativity and the individual ability to detect opportunities. Therefore, the Opportunity Recognition Support System (ORSS) can be divided into 3 areas: 1) the

knowledge can be retrieval with web content mining, 2) the pattern recognition with data analysis and 3) creativity with random association prompter. Figure 1 illustrates the ORSS framework.

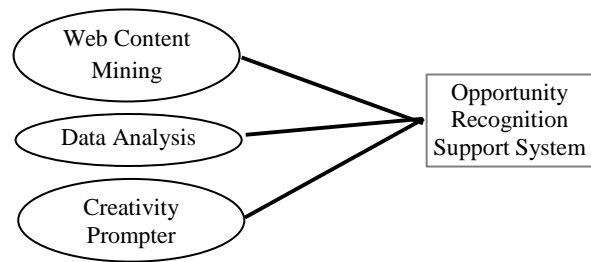


Figure 1: ORSS framework

All of these are tied together with content management that organizes, manage and present the information and knowledge. These are elaborated in the following subsections and tied together to design the prototype for an opportunity recognition support system in the next section. Identifying and recognizing opportunities are still dependent on the student entrepreneurs themselves.

### A. Knowledge Retrieval through Web Content Mining

Web content mining involves mining text and multimedia. To mine, these involve setting the target URL's, target items to be retrieved. For information retrieval needed for the study, a set of target items needs to be determined. Table 1 displays the knowledge categories.

Table 1  
Knowledge Retrieval Targets

Knowledge Categories	Target Description
Products & Services	Product and services list by company, price list, Innovative, creative, the market leader, latest product or service introduction.
Customer	Reviews of company, products and services, trends, locations of customers, stores, customer base demographic
Competition	Number of companies, size of companies, age of companies, market share, locations, growth
Technology	Latest technology, impact to industry

The web pages retrieved are checked for relevancy and categorized accordingly. Initial visual data exploration with descriptive statistics using bar charts, pie charts gives a good overview of the data for each category. The data here are labelled as basic data in ORSS and provide simple summaries of the data such as the number of companies in the industry, list of the product and services and specifications.

### B. Pattern Recognition with Data Analysis

Preprocessing the data extracted is a necessary step before proceeding with the analytics. This step includes dealing with missing values, duplicates, outliers, categorization and standardizing the data set. After the initial data exploration, descriptive analytics is conducted for deeper exploration of the data associations to detect patterns in products, customers and businesses.

A descriptive analytics technique in the study is limited to clustering to discover patterns within the data. An example is illustrated in Figure 2 showing possible market niche that is not being met. From such pattern recognition, opportunities can be discovered. It may be a customer gap that is not fulfilled in the market or a pricing point that is not being met

by any companies in the market, or even a geographical area that is not being served. This information all depends on the user on how to interpret and further investigate.



Figure 2: Analysis for pattern recognition

### C. Creativity Prompter for Business Ideas

Discovering and creating opportunities especially innovative opportunities required creativity. Hence, a creativity prompter is added into the design that functions to stimulate novel associations and trigger creative ideas. This is accomplished through providing random images from an image database for the user to associate with for possible solutions to the opportunities discovered in pattern recognition.

### D. Putting It All Together

Discovering the study is not intended to research the models, algorithms, techniques of web content mining and analytics. Therefore, for the prototype open source tools are used. The design of the user interface is important as it is through this, the user interacts with the system and it's based on theories from the field of human-computer interaction. A more graphical user interface opts for ORSS as this can present the myriad of data and information in an easier to digest format rather than just text. To avoid information overload, the users have full control of the data category (e.g. industry, market) and the data levels (i.e. basic, insight) that they would like to view with graphic representation. Information in ORSS is presented in graphs, charts and images where possible. The text is used to complement the information where necessary. Figure 2 illustrates how the ORSS flows in the planned prototype to be built to validate ORSS' model effectiveness and usefulness. An experimental design with a case study of a single market and a survey will be applied to evaluate ORSS.

In Figure 3, Screen 1 is the first page with login information where the user needs to key-in the unique identifier to proceed into the prototype. In the real ORSS instead of a login screen, it would have a search screen where users can input in the industry they are interested in and the information and insight of that industry will be displayed in ORSS. The prototype, however, is based on a single market to enable better control to evaluate its effectiveness and usefulness.

Screen 2 displays brief success stories in the related industry and the path was taken, the company, the revenue and profit of these successful entrepreneurs. The possibility of financial rewards can prime the users to pay attention to the information [20]. Providing examples is intended first, to be attention-grabbing and motivating for the user, and secondly, expand opportunity prototypes of the user. There are only 8 seconds allotted to grab anyone's attention and the information should be given within 20 minutes as adults can only sustain their attention for about 20 minutes.

After Screen 2, Screen 3 is the navigation screen with all the information categories listed as clickable buttons for the user to access the information. Examples of the categories include

the three important prior knowledge identified by researchers: market, customer problems and ways to serve the market [6][13][19]. There are two pop-out buttons labelled as basic and insight for each category. The basic button leads to Screen 3a, where it displays basic information which is information extracted from the web repositories. The insight button leads to Screen 3b where it displays the analytical results and discoveries. This is where the extracted information is transformed through analytics to give insights into the data. Patterns and trends such as factors for product segmentation are displayed here. A random association option is available for users to display random information that can be connected to get users to be more creative. The user can click and request however many random information they want. The interface is designed to display information in a piecemeal form to avoid straining the user's short-term memory.

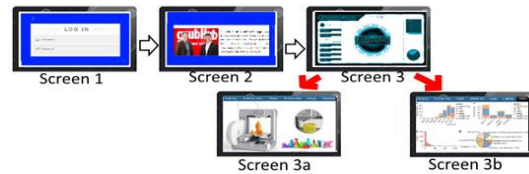


Figure 3: User interface flow for ORSS

Since ORSS functions mainly to provide information, knowledge and possible insights to the budding entrepreneur, there are no sophisticated functions. All work with the click of the mouse to access the information. Pop-up dialogue boxes of definitions are provided for any terms that may be difficult to understand. All graphical displays have captions. Tracking capabilities are added to ORSS to track and measure the duration of attention given to each information category display. Studies in cognitive psychology show that people cannot learn what they do not pay attention to. Therefore, by knowing which knowledge category and how long is spent on each display can enable the researcher to track which category and depth of knowledge affect opportunity recognition in novice entrepreneurs.

## VI. CONCLUSION

Opportunity recognition is an important step in starting a business. Without opportunity, it's difficult for entrepreneurs to even start one and with incompetent opportunity recognition ability can result in venturing into a non-lucrative business which at the end can result in premature closure. The approach to improve and enhance opportunity recognition in student entrepreneurs, a much-needed area of research as the government pushes for more graduate entrepreneurship. It is venturing into a new area which lacks research and empirical evidence. Web content mining has been used for a variety of purposes but its function in opportunity recognition for student entrepreneurs is not one of the extensively researched areas. The factors that determine opportunity recognition in entrepreneurs as the approach is drawn on opportunity recognition and what knowledge is needed to enhance this ability in student entrepreneurs. Developing an information support system is proposed to be able to help entrepreneurs in general and student entrepreneurs especially who are lacking in real-world knowledge and experience that hampers them from recognizing opportunities. The solution is limited only to facilitating opportunity recognition to generate initial business ideas. It is not to help entrepreneurs with the

knowledge to evaluate and exploit the opportunity. It is also not intended to give a list of suggestions of business ideas to entrepreneurs. Future research may want to venture into these areas and also develop an integrated entrepreneurship tool from opportunity recognition to developing the business plan.

#### ACKNOWLEDGMENT

The authors fully acknowledge Kementerian Pengajian Tinggi and Universiti Utara Malaysia for providing support as grant-in-aid which makes this important research feasible and effective.

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