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Design of a SWOT Analysis Model and its Evaluation in Diverse Digital Business Ecosystem Contexts

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Abstract

Investigating the Strengths, Weaknesses, Opportunities and Threats (SWOT) of enterprise systems is popular among business researchers in major organizations. Many establishments carry out SWOT analysis at strategic planning, quality control while formulating government policies and legislations. In the digital ecosystems scenarios, the SWOT activities need a great deal of attention, in particular, while designing and promoting new strategies of multiple industry scenarios in the Integrated Project Management context, keeping in view complex business operations. Information solutions may not have choices, failing to address priorities and provide alternate solutions. We focus on digital ecosystem methodologies, in which the business and organizational issues, challenges and priorities are addressed. The purpose of the research is designing a new SWOT model in which the elements are modelled to interrogate managers' views to oversee new insights of a variety of business contexts that can guide SWOT analyzers and provide digital ecosystem services in multiple industry operations in an optimum manner. Issues and challenges of elements of SWOT of several public and private sector companies are analyzed, documented and modelled to evaluate unified metadata representing multiple industry views, their visualization and interpretation in new knowledge domains.

Keywords: SWOT; Digital Business; Ecosystem; Multiple Industries; IPM

1. Introduction

Mostly, many organizations carry out SWOT analysis at a strategic planning stage, try to identify and examine the existing resources, both internally and externally, investigating their trends and patterns that may have either positive or negative impacts to businesses. In the digital era, many changes occur in the business strategies including organization policies. The limitations may be complex issues associated with either organizational or business

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structures, in which SWOT analysis may fail. It may not prioritise the issues neither provide alternate solutions, at times may confuse the managers with a lot of information and data generated employing SWOT analysis [22]. Quality of data and information, including types and size of data, may have a significant effect on artefact design and implementation including business sentiment analysis. With the result, the views expressed by managers on SWOT analysis may not be the same by other managers of other related industries. During oversimplification of SWOT elements and processes of multiple industries, some elements may have been oversimplified compared with others. Identification of elements that suit company situations may be dissimilar in different industries and their supply chains. Lack of control of other factors, such as inflation, changes in the price of raw materials, changes in the government policies and legislations and skills labour shortages can impede the effective SWOT analysis and implementation. We propose to build a framework that can manage volumes and varieties of views and insights of business and industry situations that can facilitate successful documentation and organization for building new models and methods needed in the IPM implementation.

The article is structured as follows. The background information is discussed in Section 1.1 with the problem statement, various issues and challenges in Section 2. The purpose of the research, research questions and objectives are expressed in Section 3 with a description of methodologies in Section 4. Data analysis and presentation of results are given in Section 5 with research findings in Section 6. The conclusions and future outlook are described in Section 7. We conclude with research limitations and practical implications.

1.1. Background information

Group of business strategies and alignments is required for organisations to achieve sets of goals in a specific time period. The business alignments and strategies are business "high-level plans for reaching specific business objectives," [1]. Organisations investigate data elements relevant to business alignments and strategies by employing SWOT analysis in different business scenarios. The SWOT stands for Strengths, Weaknesses, Opportunities and Threats, and can be analysed as a process, in which the management team identifies the internal and external factors that affect the company and business performances. Strengths in the SWOT analysis are internal capabilities and positive factors of business establishments, which are relevant for firms to achieve their objectives and serve their customers, efficiently [4, 5]. Weaknesses are internal factors or constraints which might impede or hinder the performance of an organisation. Therefore, the company's strengths and weaknesses are internal elements. Opportunities in the SWOT analysis are factors or features which can favour or facilitate the business establishments with links outside organizations. They are external factors through which companies can exploit their advantages [4]. Threats deal with negative factors external to the company, which can hinder or delay the achievable goals. As such, opportunities and threats are viewed as environmental factors. Examples of elements while carrying out a SWOT analysis are linked to attribute dimensions such as competitors, the price of raw materials and optimum supply chain management systems. New insights are made on SWOT analysis of resources, making businesses competitive and strategic with toolkits of templates [18]. IPA based SWOT analysis is done for analysing the strategic planning and evaluating through a case study of Higher Education Institutions in Thailand [16]. SWOT analysis models are articulated for wheat farming, incorporating number of strategic dimensions in the modelling process [15]. A review is conducted on SWOT in qualitative and quantitative perspectives [8]. SWOT analysis is performed in various company scenarios of strategic planning using empirical study [9].

2. Problem Statement

Many organisations fail to achieve set goals within a given time period because they are unable to fix their business strategies and alignments. It is often the case by the organisation's inability to properly implement the SWOT analysis models in business institutions. Improper implementation and failure of interpreting the information of SWOT can impede organization implement outcomes of the analysis. The interpretation phase requires organisations to assign a group of people or different aspects of SWOT into thematic clusters. The thematic groups provide analysts with a platform to easily make choices with the most relevant responses that require more attention [4]. However, individuals or groups of people carrying out the SWOT may fail to group the information into thematic views, which make managers challenging, the interpretation of the insights of SWOT outcomes.

Additionally, organisations may fail to develop or follow up an action plan even after conducting the SWOT analysis, and their interpreted views are logical. An action plan involves organisations finding an alternative solution

or a better measure to improve the businesses after identification of external threats and internal weaknesses and documentation of their data instances. However, if organisations are unable to find and implement action plans or a way forward to solve organisational issues, the entire process of SWOT exercise is futile [5]. As such, the current research aims at informing the businesses better models and methods for SWOT analysis. Based on our investigation and reviews of multiple published open and shared data source files and websites [22], we have summarized the following issues and challenges of manifold industry involvement that emerge to execute integrated projects.

Issues and Challenges: The root cause of the implication of complaints in the business process is because of the poorly aligned supply chain events and ailment of businesses. The companies suffer from interrupted networks with inferior quality products and services with poor communication systems. Sharing and managing business data in such interrupted networks is challenging due to lower internet speeds and higher costs, with the result, mounting costly bills with poor quality services, the customer dissatisfaction increases. The company may suffer from stagnated data users with rapid user growth decline. Not attending to business processes implicated in the customer complaints, poorly communicated channels may raise questions, dissatisfying suppliers and competitors. Stiff competition among suppliers also affects the growth of business in an industrial environment. For effective communication and transport services [17], the existing communication technology strategies need attention. At times, dysfunctional ERP could be the root cause of the problems which could hinder industry employees from having access to useful and critical decision-making information, such as customers' complaints in real-time, finally affecting the business reputation and IPM project implementations.

In the integrated project environment, managers dealing with resources in multiple industries may possess many branded and well-reputed products and services. Mostly, they are global with evolving customer needs and requirements including their choices. Though many case studies exist and have merits and demerits, companies participating in the IPM, struggle to compete for the market in operational areas with a pressure of gaining profits. Challenges are managing a variety of customers in the locations, where IPM is being operated and executed. Because of certain incidents or faulty warehouse materials, it may so happen in operational areas, the reputation of the company may have affected the objective of just-in-delivery of quality products and services. We extract issues, challenges, new opportunities in the areas of industrial relations and personnel management and disbursing compensation payment facilities in many company case studies. The customer sentiments are crucial in gaining popularity and promoting value and vision to branded products and services. Customer relations management and behavioural patterns are other challenges in all chosen case studies. Business processes implicated in many SWOT case studies include outdated design and redesign of workflows, not respecting companies' responses to evolving customer preferences, reputation management and infrastructure issues to meet consumer needs and demands [2].

3. Purpose of Research

The purpose is to design and develop a model that can unify the views of people involved in the SWOT analysis and bring together various stakeholders of industry, enterprises and institutions. It is a process where the management team identifies the internal and external factors that affected the company's performance and influence the business. The company's strengths and weaknesses are internal factors. Opportunities and threats deal with factors external to the company--environmental factors.

3.1. Research questions

1. Why do we need a SWOT analysis framework?
2. How do we make use of SWOT analysis framework, capitalizing businesses in multiple industry environments?
3. How do we implement the SWOT analysis framework in spatial-temporal dimensions and what do we expect from SWOT implementations in the IPM?

3.2. Research objectives

We focus on various interconnected industries of IPM. Oil and gas, mining and metallurgy, manufacturing, transport, agriculture and lastly food and marketing are business entities. Broadly, the objectives of the study are:

1. To identify, acquire, document and model different elements of SWOT in multiple industry contexts.
2. To develop a methodology that examines issues and challenges which hinder businesses from achieving set goals and explore solutions. The method can bring all views and insights of SWOT into the framework.
3. To implement the framework solutions in multiple dimensions that can make up and strengthen businesses, minimizing weaknesses and external threats.

To address the research questions 1 and 2, we focus on building an integrated framework with artefacts that collaborate with businesses and their alignments. The research question 3 is addressed by the SWOT model that can facilitate implementing the structural framework in multiple industry scenarios that can make up the IPM project. We consider multiple industries, identifying their internal strengths and weaknesses, as well as its external opportunities and threats. Examples include various instances linked with competitors, prices of raw materials, suppliers, and project needs and requirements. A SWOT analysis organizes strengths, weaknesses, opportunities, and threats into a structured list. It is usually presented in a simple matrix form [20]. The SWOT analysis is characterized in a framework for identifying and analyzing the internal and external factors that have an impact on the viability of a project, product, place or person entities. The following steps are used to carry out systematic SWOT analysis in multiple industry contexts:

1. Choose objective of SWOT analysis.
2. Examine the business, industry and market situations.
3. Identify and list the business's strengths.
4. Categorize and list business and or industry weaknesses.
5. Classify and list potential opportunities in various business and industry perspectives.
6. Organize and list potential threats of businesses that represent multiple industries.
7. Ascertain priorities from SWOT elements and their analysis.
8. Build and improve a strategy to address the issues and challenges of SWOT in multiple industry contexts.

3.3. How can organisations carry out a SWOT Analysis?

For identifying, documenting and modelling different elements of SWOT in multiple industry contexts, an integrated framework is proposed with artefacts to primarily focus on integrating and analysing internal and external factors that impacted industry or increased industry involvement in IPM. Firstly, an organisation needs to decide the objective of the SWOT analysis. Significance of ascertaining the organisation goals is to keep the company focussed on SWOT analysis and modelling various dimensions of industries. Secondly, the organisation needs to research its industry, business and market situations, to be able to list instances or occurrences of business strengths, weaknesses, potential opportunities and threats. Lastly, the organisation should be able to establish its priorities from the SWOT analysis, then develop a strategy to implement SWOT research outcomes. The artefact development involving multiple dimensions from diverse industries is the focus of the research. We make use of data models and reuse in various company scenarios and case studies.

Various data sources published in [22] have been considered in SWOT analysis and multidimensional modelling. As described in Table 1, several attribute dimensions related to multiple industry entities have been identified and documented for modelling in multidimensional data schemas. Different public and private sector companies in oil and gas, mining, metallurgy and refining, their connected manufacturing, transport, fertilizer, agriculture and food-related industry entities are considered. In integrated project development, the increased industry involvement starts from oil and gas production and translating it into essential food making commodity using supply chain scenarios.

Table 1. Modelling Attribute Dimensions pertained to Multiple Industries - for SWOT analysis

Companies, businesses	Public Undertakings	Private Sectors	Data Attributes
Oil and gas	21	25	1600
Mining, Refining and Metallurgy	15	30	2000
Manufacturing	25	56	2500
Transport	22	39	3500
Fertiliser	25	30	2100

| Agriculture | 23 | 48 | 1900 |
| Food and Nutrition | 15 | 35 | 2500 |

4.   Design Methodology

The research objectives 2 and 3 have been followed up in this section. We aim at developing a methodology that examines issues and challenges, achieves set goals and explore solutions. The method can bring all views and insights of SWOT into the framework. The sample design for the study depends on the number of domains (industry entities) and their associated linked businesses mentioned in Table 1. Typically industries in IPM hold oil and gas, mining and metallurgy, manufacturing, agriculture and lastly food and marketing business entities. The number of sample attributes and its attribute instances for each industry is in the range of 1000, using the random sampling technique to minimise chances of being biased.

IT solutions and practices: Business process engineering and management practices in industrial scenarios have the opportunity adopting software systems, Customer Relations Management (CRM) and Enterprise Resources Planning (ERP) for integrating applications from multiple industries [6] as well as customers associated with different organizations. Managing businesses through frontend and back-office IT applications, automating services and human resources in the companies need attention. Centralized ERP systems may facilitate the industry databases that store various types of data and interrogate them for multiple functions through computerized automation. The ERP can integrate the data sources linked with planning, purchasing, inventory, sales, marketing, finance and human resources. The entire process can help industrial scenarios to align and streamline their business activities and processes through customer interaction or relationship and accessing related customer related personal and business information. Both systems can facilitate the industries improving their sales and marketing. Based on issues and challenges, we identify possible IT/IS solutions and their practices. SWOT framework is a robust and holistic data modelling that can adapt to a variety of situations and contexts of businesses and organizations, as described in the following sections.

4.1.   Modelling attribute dimensions – SWOT analysis

It is vital to put forth all facts and figures of multiple industry scenarios and organize their instances in a way that users can perceive and extract knowledge for interpreting the multiple supply chains, their merits, demerits, advantages and inadequacies. Data warehousing and mining methodologies are used in these industries [7, 10] to address data integration and interoperability issues. Keeping in view the data management and application issues in the current research, we propose the data schemas and integrated frameworks to explore and make connections between attribute dimensions.
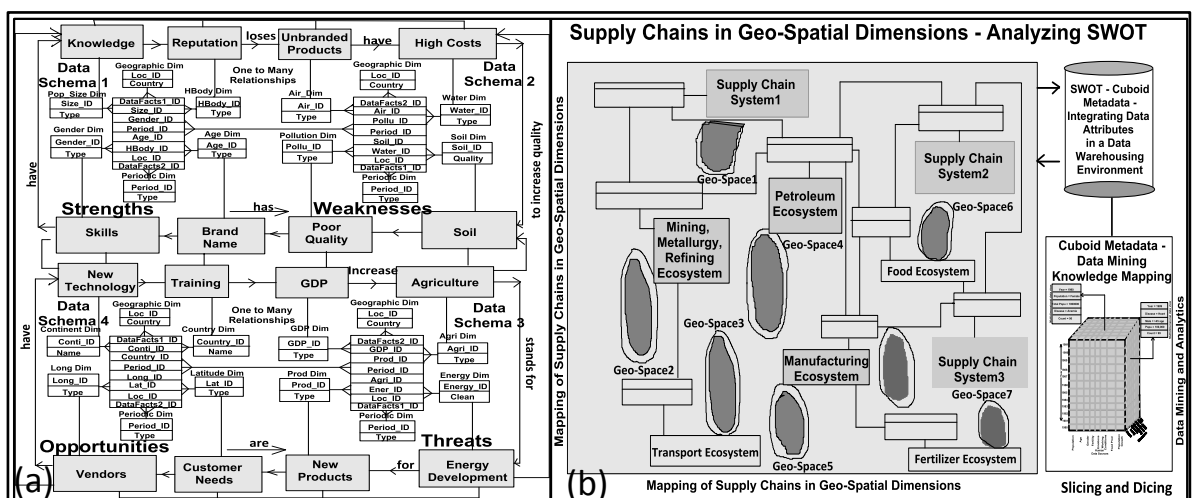

Fig. 1. (a) SWOT schema architecture – connecting attribute dimensions from multiple schemas (b) An interoperability framework represented in geo-spatial dimensions

A schematic view of an interoperability framework is drawn in Fig.1b, demonstrating the connectivity between systems and their related businesses. The relevant data dimensions and instances used in the current modelling studies

are described with the depiction of ontology structuring [12, 13, 14]. Often, *point*, *line*, *spatial* and spatial-temporal datasets vary with space and time based on the geography of the industry or business. Hundreds of dimensions and their attributes are involved in multiple businesses including periodic dimension [7]. We have described four different data schemas, Schemas 1, 2, 3 and 4 representing four interconnected elements of the SWOT schema architecture designed for multiple industries and business contexts as shown in Fig. 1a. At conceptual and logical model stages, the dimensions and facts are made interrelated between SWOT elements. At the physical model stage, the dimension attribute and fact tables are designed that suited to the ecosystem, business and the data integration processes.

We have identified key factors of SWOT that deal with these industries. Various entities, dimensions and fact instances are gathered. Realistically, we have analysed on average 50 government organizations, private sectors and small scale industries with a rigor that deal with energy, manufacturing, transportation, agriculture and food-related industries. We have integrated the new insights of SWOT elements and examined a strategy to improve digital business ecosystems mitigating the existing risks and curtailing new threats in the industrial environment. The case studies that deal with SWOT have been analysed for IPM including e-businesses [21]. Broadly, we interpret the following new insights from several company entities:

Oil and gas, mining and metallurgy business: Strength of the major oil and gas companies is becoming part of the Organization Petroleum Exporting Countries (OPEC) member countries. Continued energy consumption and growing demand for petroleum products are other strengths. Crude quality, distribution of petroleum resources meeting the demand and supply of both domestic and world consumers because of available production facilities including refining capacities. High costs involved in developing the alternate and or unconventional petroleum resources and development technologies is the weakness including corrupt practices in financial sectors of producing companies. The dominance of private and small scale enterprises make difficult to regulatory measures. Inadequate infrastructure, lack of health, safety and environment measures are other challenges. Several new opportunities have been generated in the form of supply chains diversified and linked with mining, refining, manufacturing, agriculture and food industries. It includes further exploration and production of untapped resources and job opportunities. High recovery rates create new momentum from the existing projects. Liquefied natural gas (LNG) imports and exports have substantially increased among energy consumed and produced nations. Depletion of oil and gas reserves, developing alternate or unconventional resources by rich countries, rising fossil fuel costs and world economic crisis are big threats. Increased competition between government and private organizations, continued government interferences and change in national energy policies are other threats. Traditional energy systems and their data sources may be threats to green and renewable energy growth. SWOT thus can bring issues and challenges of supply chain events of multiple industries, such as mining and refining, manufacturing, transport, marketing, agriculture and food-related businesses including awareness and guidance to the policymakers to manage and make projects viable and feasible.

Manufacturing business: Brands, loyal customers, high-quality product materials, innovative designs, short-lived product development, an increased ability, adaptability to keep the pace of demand and supply and capacity to generate new products. Continued manufacturing demands and their achievable targets depend on continued energy supplies from petroleum companies. A small range of products, high production costs, outdated machinery and constrained budgets are weaknesses of manufacturing companies. Poorly linked energy resources to manufacturing with uneven energy supplies are other weaknesses. Opportunities arise with the production of new goods and services at short periods and reduced costs. Investment opportunities in manufacturing industries depend on the procurement of new machines, uninterrupted supply of quality raw materials and generation of new skills through training and development programs. Business budgets must align with achievable business goals and targets. Lack of operational skills and personnel, obsolete technologies, interrupted energy supplies, poor quality raw materials, market and fiscal fluctuations including inadaptable tax regimes can be threats to manufacturing industries [19].

Transport business: The strength of transport business, in the context of IPM, lies with facts of focused distances for timely passage of raw materials from warehouses to operational areas [3]. Branded companies can engage transport systems with priority routes by road, railways, air and even sea to operational areas that can facilitate cost-effective oil and gas, mining, metallurgy and manufacturing industries. Maritime routes are inexpensive but time-consuming. New logistics and infrastructure entities that can deliver just in time product and customer services have to be the key strength of any transport system. High priority transport networks and partnered shipment companies may have to be committed with IPM-focus in the entire life cycle of the supply chain system of multiple industries. Often, transport

costs and poor quality services make transport businesses weak. Poorly designed transport routes, imbalance of trade flows and time-consuming and uncertain routes make the transport business unsustainable especially considering operations from multiple industries. Customs duty, high transit costs and procedures including safety and security situations at border crossings restrict transport operations. The new and rapid growth of opportunities exist due to new transport routes, alternate shipment openings and consignments, increased security scenarios and increased cooperation between governments. Modern transport and maritime restrictions in some countries make businesses threat. The economic sanctions, restricted movements of shipment and containers and political instabilities are other threats of transport businesses.

Fertilizer business: For maintaining surplus food grains in increasing urbanization and decreasing capacity of landholding, the need for quality chemical fertilizers is greatly realized. Ammonia urea is high-energy intensive fertilizer. Natural gas, naphtha and other fuel oils are often used in the fertilizer industries. Energy and its capacity to produce by-products from crude oil are demanding in fertilizer businesses. Increased availability of fertilizers is key in producing more crops in less time and has a definite advantage of generating and procuring more petroleum products. The strengths are the internal structure of fertilizer companies and good management practice because in populated countries rice and wheat production have established their strategies. Technology innovation, adoption of new technologies, skilled and competitive employees are other strengths in these industries. Interrupted gas supplies, not meeting demands of fertilizer supplies, poor quality seeds and selection and seasonal effects make fertilizer businesses weak. Outdated technologies, inadequate research and development, uncertain supply chains and management make the businesses ineffective. Unpredictable rain and irrigation patterns constrain the use of fertilizers in countries where soil qualities, insufficient water application and farming mechanization do not permit. Quality circles and farmers of international exposures, automated farming, global marketization through online markets, and distribution network among demands and supply of pesticides, bio-fertilizers and research seeds are new opportunities. Innovation, new technologies, flexible regulations attracting new markets are other opportunities. Market crash, the supply of inferior quality fertilizers, stringent government regulations, fierce competition, political risks and volatile revenues make fertilizer market conditions disorder and disloyal [20].

Agriculture business: SWOT in agriculture business offers simple and efficient solutions to manage the elements and their data instances. The checks and balances if known in advance, the industry can better be managed and integrated with various supply chains of associated industries. The growth of agriculture products depends on new farming technologies, quality seeds, automation and efficient use of available resources. Farming practices play a crucial role in food production and security. Chemical fertilizers are crucial in making bulk production of agriculture products and linked crops. Planting of seeds and crops with high economic values, government subsidies, encouraging organic farming and sustainable water and energy resources management are added strengths of agriculture and can add value to the food industry. Limited loans and at places their prohibition, and non-availabilities of government subsidies, not getting good selling rates, poor quality seeds and thus crops make the agriculture businesses weak. Interrupted supply of fertilizers and raw materials needed in farming, frequent load shedding, poor quality farming practices including marketing conditions are added weaknesses of the growth of the agriculture industry. Uninterrupted energy supplies, reaching to quality seeds, new bank financing agriculture, automated farming, improved supply chains of multiple industries, better market for crops and amended regulations on subsidies can help facilitate the growth of agriculture and food. Bank lending, high-interest rates, price control on essential commodities, stringent tax and fiscal regimes and increasing competition in the industry are notable threats of the agriculture business.

Marketing business: To promote marketing strategies, constructive attributes related to resources, competitive business advantages, the skilled workforce can add up value to the marketing strategies. Lack of expertise, constrained resources and technology, substandard materials and services including the shortage of infrastructure can make the integrated business nervous and weak in project design and implementation. In the contexts of integrated project management contexts, several new marketing opportunities exist to benefit the timely project execution and implementation, facilitating and promoting a high degree of values of products and services among competitors. Unsustainable price increase by suppliers, stiff government regulations, economic slumps, negative media stunt, changes in consumer behaviour and sentiments can be threats to market businesses, making the products and services outmoded for promotion.

5. Data Analysis and Presentation

Measures needed to minimise the complaints: We ensure improvements in customer relations, bridge communication gaps and gain popularity of suppliers and their businesses. The information systems driven logistics and supply chain management are in place at all operational units. Morale and motivation of employees and building good relationships between company, employees and valued customers are other measures. With the aid of business process reengineering, integrated project management connects the activities, tasks and functions of the organization and various other events through various reengineering workflows to make the enterprises and businesses productive and constructive. It can facilitate the companies' chain of business events in a more structured way. Each chain of an event has a specific data or information about the fact. Multiple chains of events imply different types of data are used to make connections between businesses and their tasks. Examples may include logistics and supply chain management systems, in which various elements and processes are described as in [17]. Demand management, communication, integration and collaboration are typical elements, which have a variety of data. Similarly, planning, procurement, manufacturing, warehousing, transportation and order fulfilment are processes, which have different types of data. In the Business Process Reengineering (BPR) scenarios, all the elements and processes are expressed in various workflows [21] to be able to link the supply chains, eliminate the communication barriers and improve product and service qualities. These practices ultimately facilitate in making business alignments between company entities.

SWOT analysis: Multiple industry scenarios are targeted, pinpointing the emerging issues and challenges that are accommodated in the integrated project management scenarios. Exploration and exploitation of oil and gas, refining, and metallurgy of raw materials, transporting energy needed in manufacturing, fertilizer and food industrial units are key functions and activities of SWOT analysis attributed to integrated project management. The overall purpose is to transport timely resources as per supply and demand necessitated in the project execution and implementation. Providing quality materials and services to large size integrated projects is the crucial motivation of SWOT analysis.

Table 2. Interpreted assets and their instances for companies and organizations given in Table 1 - SWOT analysis and motivation

Users/Tools/Technologies	Number of Strengths	Number of Weaknesses	Number of Opportunities	Number of Threats
User Involvement	12	4	7	3
Funding	16	3	6	4
Organization Setup	13	5	7	2
Sponsorship/Mgt. Support	14	1	5	5
Project Scopes	11	6	6	3
Data Sources	23	8	11	7
User Access Tools	10	5	6	5
Technology Choice	9	4	7	3
Overheads	5	2	3	1
Turnover of Personnel	3	1	1	2

6.   Findings

We implement the framework solutions in multiple dimensions, minimizing the weaknesses and external threats of business scenarios. The model can be used to strengthen the strategists, making businesses, organizations for planning, controlling and functioning of operational units including the delivery of quality products and services to integrated projects that involve multiple industries and diverse supply chain systems.

The findings are presented from empirical research outcomes and modelling done through secondary data sources. The metadata derived from the SWOT schema architectural modelling and interoperability framework, we deduce various data and plot views. A couple of them is presented in Fig. 2, demonstrating the connectivity and interoperability among multiple domains of diverse industry scenarios. Bubble plots can reveal trends of dependent or independent variables of SWOT elements in different scalar descriptions. The diameter of each bubble either in 2D or 3D bubble plot, varies in size and density of clusters, providing a way to explore and represent additional dimensions in the empirical data. The encircled bubble plots in Figs. 2a and b, suggest closely related attribute dimensions and their instances, implying better-connected attributes of total primary supply and demand entities necessitated in SWOT associated projects. In addition, it ensures that first-hand information is attained from the businesses for SWOT analysis. As described in Table 2, in IPM multiple industry contexts, keeping in view the more instances of strengths and opportunities, the project is feasible with a low level of weaknesses and threats. Additional sources such as

websites, online articles and research papers were used to have a wider range of opinions from business researchers and data analysts in the current field of study [22].
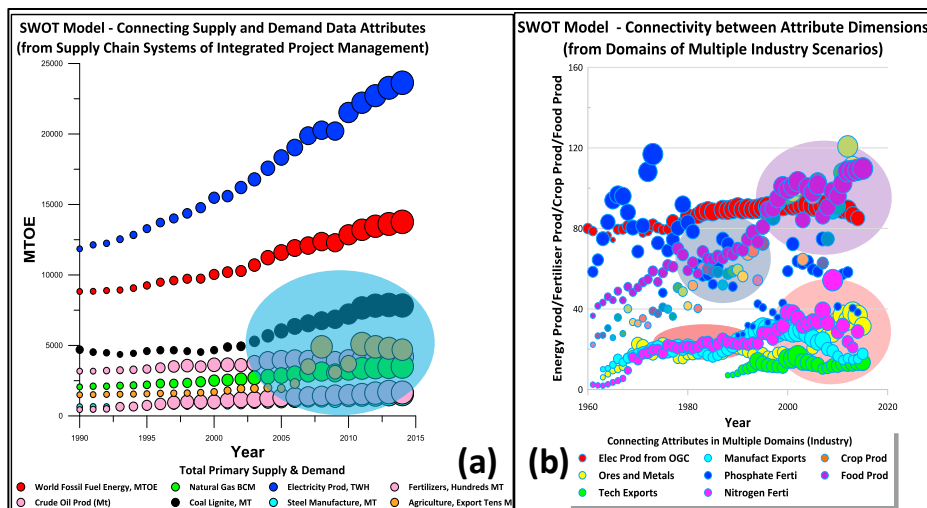

Fig. 2. SWOT Analysis – (a) Primary supply and demand scenarios of multiple industries in the IPM (b) Establishing connectivity between attribute instances of data sources in multiple industries

The metadata deduced from integrated frameworks, are used to visualize and present the data views in forms of bubble plot and maps, to have a quantitative view and clear understanding of each and every business involvement in the SWOT analysis. Variety of user options are available to present, visualize and interpret their data views to assess the business contexts and their deficiencies and inadequacies including successes and failures causative to project execution and implementations.

7. Conclusions and future outlook

The need of SWOT in multiple industry contexts is discussed. The necessary attribute dimensions in all domains of chosen industries are identified for multidimensional modelling. Supply chain events from multiple industry situations incorporated in the framework and integrated in a warehouse environment are useful for SWOT analysts and business researchers. The methodology is valuable in a sense, the artefacts of SWOT analysis are used and reused in multiple application and knowledge domains. The constructs and models unify the views of the SWOT users and analysers that further facilitate connect industry stakeholders, enterprises and multinational organizations. The implementation in the contexts of multiple industries and integrated business environments is successful. There is a future opportunity of Big Data in managing multiple industry scenarios and their SWOT analysis for improvising the IPM. However, research limitations and practical implications are described in the following sections.

8. Research limitations and Practical implications

SWOT analysis has more advantages than shortcomings, especially when considered multiple industries in IPM projects. It is capable of analysing multiple domains and systems quickly through multidimensional modelling and analysis, and data integration. Simplicity in modelling, connectivity and interoperability have no additional costs. In the traditional sense, though it is difficult to find out the impact of each SWOT element on the other, the current research eases perception of its influence and connectivity between elements including minimizing any ambiguity that may exist during data modelling stages. Though a lot of information produced through SWOT analysis, at times it is challenging to manage a number of alternative solutions and decisions, the current data modelling and integrated solutions can help and facilitate prioritize issues and challenges that are necessary for successful IPM project implementation. The semantic and thematic tools and technologies should be able to handle the views and opinions of people involved in the SWOT and sentiment analysis of strengths, weaknesses, opportunities and threats. Data model and interoperability framework have huge implications in multiple industry outlooks, where IPM needs better resource management and optimization.

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