Petroleum Business Review, Vol. 7, No. 2, pp. 1–14, April 2023

A New Stage-by-Stage Itemized Model for Assessing Patent Portfolio and Commercialization in Petroleum Incubators

Ahmad Mousaei[1], Mohammad Ali Hatefi[2*], and Seyyed Abdollah Razavi[3]

[1]Assistant Professor, Research Institute of Petroleum Industry (RIPI)
[2]Assistant Professor, Petroleum University of Technology
[3]Assistant Professor, Tehran Faculty of Petroleum, Petroleum University of Technology

Highlights

- Identifying several contexts for patent evaluation;
- Proposing an itemized model to evaluate the patent portfolio;
- Proposing ways to apply the model to real-life cases.

Received: October 11, 2022; *revised:* January 14, 2023; *accepted:* February 21, 2023

Abstract

Today, research and development (R&D) activities in petroleum incubators are vital, and it is necessary to investigate different ways of commercializing the patents of these activities. Formulating a petroleum incubator strategy and coordinating it with technology strategy and corporate strategy can reduce the technology development and commercialization period and create comparative advantages. In this paper, we develop an itemized model to draw a bead on the activities of petroleum incubators in a patent portfolio framework and to improve the efficiency and effectiveness of petroleum incubators. The model includes several categorized items that can be considered stage by stage. If this model is deployed in steady stages, the petroleum incubator can ensure that every newly created idea will be commercialized. Moreover, a considerable characteristic of the proposed model is the existence of programs for the patent's application in prevailing and newly created markets and commercializing the patents of R&D activities to prevent the accumulation of unused knowledge in petroleum incubators. At the end of the paper, some suggestions to employ the model in real-life situations are presented.

Keywords: Market Research, Strategy, Technology Package

How to cite this article
Mousaei, A., Hatefi, M. A., Razavi, S. A., A New Stage-by-Stage Itemized Model for Assessing Patent Portfolio and Commercialization in Petroleum Incubators, Petroleum Business Review, Vol. 7, No. 2, p. 1–14, 2022. DOI: 10.22050/pbr.2023.365317.1281

1. Introduction

The idea of an incubator is usually used as a general denomination for organizations that constitute a supportive system conducive to developing new firms. These incubators have become a ubiquitous entity in many aspects of the world. Policymakers have come to view them as a device for enhancing economic development, innovation, and the emergence of new technology-based growth firms (Bergek and Norrman, 2008). A petroleum incubator is a unique and exceptionally adaptable mixture of business research and development (R&D) procedures, infrastructure, and humans, provided to nurture and grow

* Corresponding author :
Email: hatefi@put.ac.ir

new and small petroleum businesses by reinforcing those using early stages of development and change (see Figure 1).

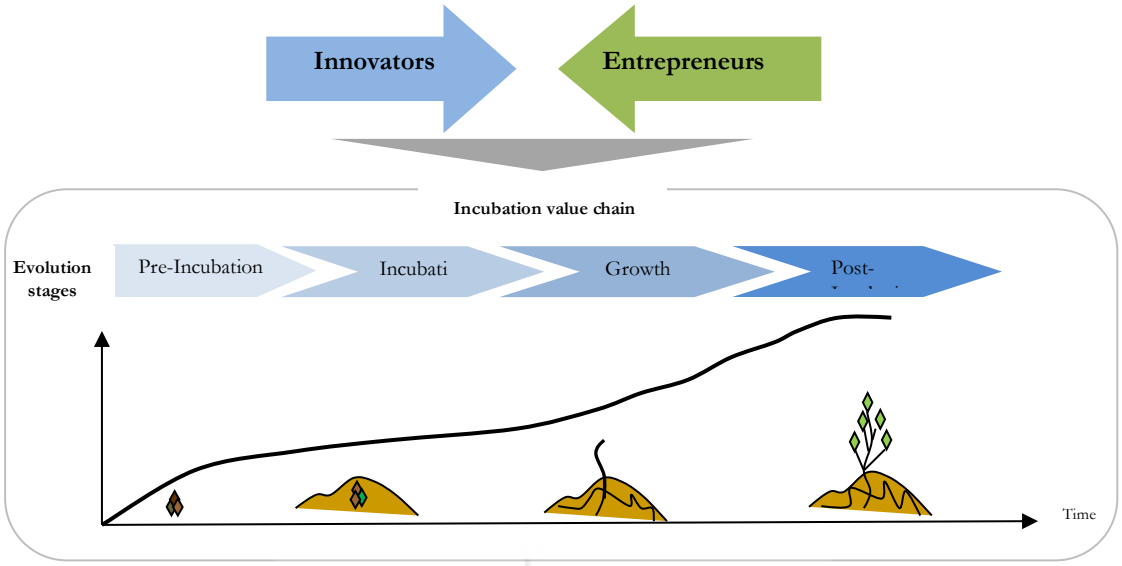

Figure 1

Incubation value chain

Let us conduct a brief literature review herein. Rothaermel and Thursby (2005) investigated the research question of how knowledge flows from universities to incubators. They assessed the influence of these knowledge flows on incubator-level differential performance. Their evidence recommended that the incubator's absorptive capability is fundamental when transforming university knowledge into incubator-level competitive advantage. Maniyan et al. (2016) proposed a business model for virtual business incubators in Iran based on a review of the related literature, interviews with experts, and benchmarking results of various successful virtual business incubators worldwide. Holgersson and Aaboen (2019) displayed a literature review of the intersection between intellectual property (IP) management and technology transfer offices (TTOs) for the sake of finding out how TTOs handle IP. The results showed that previous studies of IP management in TTOs tend to adopt a simplistic perspective of IP management, recommending that all considerable inventions should be patented. Additionally, the academic investigation into TTOs and actual TTO practices both appeared to concentrate on enhancing efficiency and yields measured in terms of the number of patents, licenses, and spin-offs.

Matour and Ameri (2021) discussed the interplay between IP rights and competition law in the context of technology transfer in the Iranian oil industry, which is a point this work discusses. Pattanasak et al. (2022) conducted a literature review on key performance indicators of business incubators. They reviewed 74 studies published between 2005 and 2020. They identified six categories for performance measures. De-Esteban-Escobar et al. (2022) sought the answer to this question: Have business incubators as facilitating institutions of entrepreneurship been determinants for the survival of startups? Their study was carried out using a statistical method of evaluation based on the application of structural equations modeling (SEM) on a theoretical framework built and validated empirically in a representative sample of entrepreneurs from the community of Madrid in Spain. Chang and Cheng (2022) used a probabilistic model to empirically describe the relationship between entrepreneurial mentoring or financial support and incubator patent licensing. In addition, they performed a statistical test to discover whether province-level incubators enforce policies to strengthen the effect of

entrepreneurial mentoring and financial support on incubator patent licensing. Pandey et al. (2022) examined international technology transfer in the health, agriculture, climate, and energy areas and incubators (including oil and gas). They suggested that innovation cooperation is a better framing than technology transfer for advancing international activities on technology for sustainable development. Baghdadi et al. (2022) identified and prioritized commercialization components in Iran's gas and oil industry to transfer technology to other industries and organizations.

In the end, it should be noted that reviewing the related state-of-the-art depicted that the idea of the current paper has not been studied. The research problem concerns the absence of a comprehensive model for assessing patent portfolio and commercialization in petroleum incubators in our country. In addition, the current paper offers a novel stage-by-stage itemized platform for evaluating patent portfolios and commercialization in petroleum (oil, gas, or petrochemical) incubators.

The structure of the paper is as follows. Section 2 describes the research methodology, and Section 3 offers fundamental concepts employed to build the procedure of the proposed method. In Section 4, the proposed methodology is discussed. This section contains an explanation of the 13 stages of the proposed model. Section 5 answers the following question: How can an analyst employ the proposed model in a real-world situation? Section 6 performs a Delphi analysis to validate the proposed methodology. Finally, some conclusions and recommendations are provided in the last section.

2. Research methodology

The proposed model is based on (1) the knowledge and experiences of the authors, (2) the existent models in the related literature, and (3) the corrective comments of subject matter experts (SME). To perform the research, the following steps are taken:

1. A complete literature study is carried out on patent portfolios, commercialization, incubators, and technology transfer. This study includes recognizing Iran's petroleum industry's requirements for technology development. The findings of this step are discussed in Section 3.
2. The stages and items of the proposed method are drawn up (the readers will see that the proposed model consists of several "stages" and several "items"). After that, a Delphi process is performed to refine and finalize the stages and the items. In the end, the framework of the model is formed. To this end, a panel of 10 related SMEs is organized. The SMEs sufficiently realize the matters of patent portfolio and commercialization in petroleum incubators, and their knowledge/skills are acceptable to make appropriate judgments. The findings of this step are shown in Section 4.
3. Various ways to apply the proposed model in real-world cases of the petroleum industry are designed. The findings of this step are discussed in Section 5.
4. Model validation is conducted using another Delphi process and other experts. The findings of this step are explained in Section 6.

3. Preliminary concepts

This section defines, discusses, and reviews the fundamental concepts employed in the proposed model. The following titles are used to establish the procedure of the proposed model.

3.1. Incubator goal

Any petroleum incubator requires goals for future activity and planning. It is vital to develop goals integrated with environments and the global market. These goals should come with a time frame and measurable criteria. These goals must also overcome the competition problems (Ricupero, 2003). All

kind of petroleum incubators have their own goals. Generally, the primary purpose of R&D-oriented entities is doing pure basic or applied R&D, but they also may focus on technology commercialization (Teece, 2018).

3.2. Incubator strategy

Petroleum incubator strategy follows general definitions around the term organizational strategy. For example, an incubator may define its strategy as determining the fundamental long-term goals related to the petroleum industry, adopting the courses of action, and allocating resources necessary for achieving the objectives. As another instance, an incubator may set up this strategy: a multipurpose and integrated program built to assume that the primary goals of the petroleum industry are achieved.

3.3. Technology foresight

Technology foresight concerns the most upstream components of the technology development process. Technology foresight makes inputs for formulating technology policies and strategies that help develop the technological platforms. Moreover, technology foresight creates support for innovation and incentives and assistance to enterprises in the domain of technology management and technology transfer, promoting competitiveness and growth. Technology foresight has been known as a powerful tool for establishing common perspectives on future development strategies among policy-making bodies (UNIDO, 2020).

3.4. Market research

Marketing is not at the center of attention in most R&D centers but is vital for technology commercialization. The most essential part of technology diffusion in the cluster is verifying the cluster products' future market. The aim of marketing in the technology creation part of the cluster is to assess the business potential of the technology and its product. One of the most valuable tools for marketing is market R&D, which complies with data gathering, analysis, and decision-making. Today, business marketing of technology and products is a part of the economic activity (Kotler, 2000). There is a dynamic relationship between innovation and marketing. By another means, the consequences of the technology will lead to the launching of new products into a market and bring up new opportunities for industrial development. Notably, the new technology should be market-driven because the market must prefer whatever the technology outcome (Jobber, 2002). In some situations, the industry forces the companies to renew their technology; in others, scientific enhancement pushes the enterprises to research and renew technology. These renewals usually bring new market opportunities. Figure 2 illustrates the relationship between those forces and innovation enhancement. Therefore, for any technology upgrade, market R&D is a necessary activity in the process (Khaill, 2000).

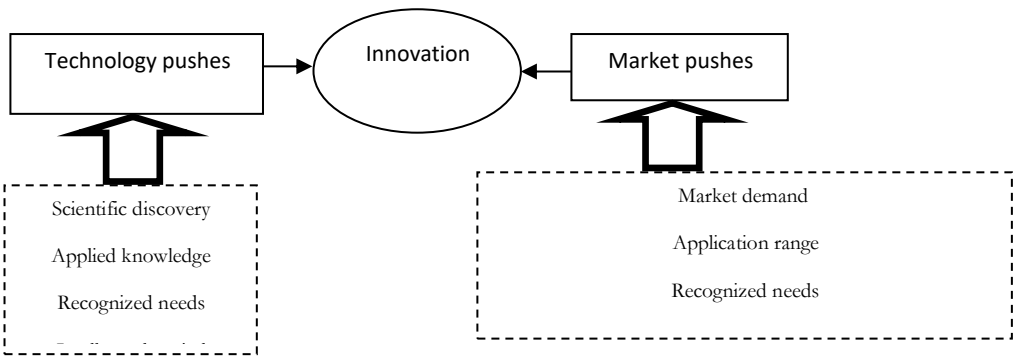

Figure 2

Relationship between environmental forces and innovation (Jobber, 2002)

3.5. IP strategy and IP portfolio management

Some studies are related to IP and technology transfer (Matour and Ameri, 2021). In this regard, different researchers have demonstrated a positive correlation between a firm's success and the power of its patent portfolio. An IP strategy has to, therefore, aim to develop a high-level patent portfolio. A patent portfolio is a mixture of patents owned by a single entity, such as an individual or corporation. The monetary yields of a patent portfolio consist of a market monopoly position for the portfolio holder and benefit from licensing IP. Nonmonetary findings contain strategic superiorities like first-mover advantages and defense against rival portfolio holders. Patent applications often lead to revenue growth in two to three years. IP has reached higher importance in several successful firms and has been identified as a powerful way for innovation and technology management to overcome discontinuities. Table 1 presents definitions of IP portfolio management tasks (Burdon, 2007).

Table 1

IP portfolio management task definitions (Burdon, 2007)

IP task	Definition, scope, and complexity
Scanning technology	Monitoring the patent and non-patent literature to measure the current technology situation
Current awareness/IP surveillance	Surveying newly existing patent applications and reinforcing patent intelligence/competitive intelligence initiatives
Licensing/business development IP support	IP portfolio maintenance, patent-prosecution assistance, updating patent status information, and generating reports on IP status
Patent development/patentability	Searching and analyzing to determine identical or similar technologies
Patent landscape	Evaluation of IP in specific technology fields; Integrating IP evaluation data into a defined format, such as a landscape, enables high-level overviews and detailed assessment.
Infringement	Evaluation to determine if a new product released to the market may infringe one or more patents
Validity of patent	A search and analysis for a prior art reference that may render a target patent or patents invalid

3.6. Technology roadmap

Roadmaps can take a variety of frameworks, but the most common way is encapsulated in the general form presented in Figure 3, representing how technology can be aligned to developments of products and services, business strategy, and market opportunities. Thus, a general roadmap is a time-based diagram containing several levels, including commercial and technological views. It enables the analysis of markets, products, and technologies to be discovered and the connections between the different views. A roadmap is a straightforward graphical tool for mapping the organization's plan. The three most effective uses of a roadmap are (1) planning process improvement, (2) efficient R&D management, and (3) new product or service development. On the other hand, decision-making with the help of a roadmap is in the middle of technology pushes and market drives. In the technology push part, a group of technology enhancement projects will be reviewed to determine the future of technologies. In the market-driven part, based on customer needs, the technologies must be invested in by a specific time frame (Khaill, 2000).

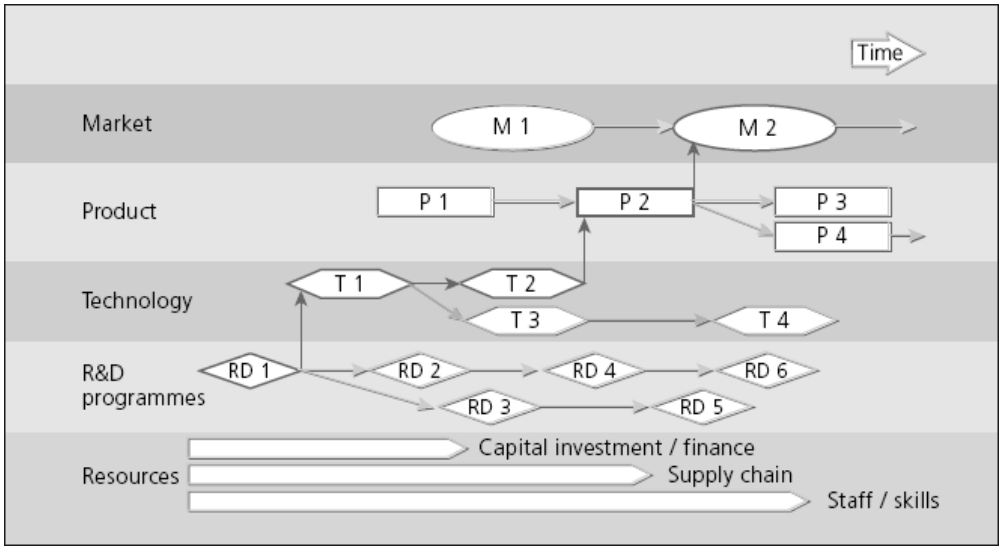

Figure 3

A schematic technology roadmap (Khaill, 2000)

3.7. Technology evaluation

Enterprises usually assess their product technology or the potential technology that they have on hand (Braun, 1988). This evaluation includes two different types: (A) technology attractiveness assessment and (B) technology capabilities assessment (Arasti, 2004). The attractiveness of technology for an organization is where the technology can bring or create a new competitive advantage for the enterprise. This criterion usually depends on the uncontrollable factors. The capabilities assessment evaluates the technological gap and its strengths and weaknesses. The aim is to justify the firm's position related to its competitor, market leader, or the specific criteria defined by the experts (Panda and Ramanathan, 1996). It is vital that after the recognition of the weakness of the firm's technology, the related solution be defined. Two central problems organizations face regarding technology are as follows (Braun, 1988): 1- lack of financial resources for technology development, and 2- lack of knowledge related to technology.

3.8. Technical and economic evaluation

A feasibility study identifies challenges and opportunities, specifies goals, explains cases, introduces successful yields, and evaluates the extent of costs and benefits related to various options for resolving an issue. This study reinforces decision-making activities based on a cost-benefit analysis of actual business. A feasibility study is performed during the deliberation stage of the business development procedure before a formal business program is commenced. It is an analytical method with recommendations and constraints to help the decision-makers. Technology should be reviewed from two different aspects: technical and economic. In the technical part, the analyst checks if required infrastructures, places, scales, and processes are available. In the economic part, a cost-benefit analysis is accomplished.

3.9. Technology development

A technology development plan aims to deploy a qualified, high-performance, and economical technology that meets the market's demands. Similar drivers that drive shrinking product procedures also drive shrinking technology development procedures. The most substantial element is technology

development in the production line of the system. Thus, the technology commercialization division finds a group of technology-related companies and negotiates with them to implement the technology in their structures. This is a very complex task and needs accurate information. The next task is to define the technology in terms of the system, process, products, and business procedure of the technology usage (Ravi et al., 2003).

3.10. Technology localization

Technology localization consists of R&D required to reinforce the absorptive capabilities of the system. Technology localization stresses the development of local technical human resources and policy structures to enhance the importation of beneficial foreign technologies and create spin-off technologies in the system.

3.11. Technology transfer

In addition to the use of technology in the production of products, technology commercialization to transfer technology to other organizations is considered a practical approach to gaining business benefits (Baghdadi et al., 2022). Technology transfer is more than just moving high-tech instruments from the developed world. It encompasses more than instruments, tools, and other complex technologies; it also contains total systems and their components, including know-how, products, services, equipment, and all the organizational and managerial instructions (Majidpour, 2017).

3.12. Technology commercialization

Technology commercialization is the activity of transforming new technologies into commercially successful products and services. The technology commercialization consists of trials such as market evaluation, design and engineering, management of IP rights, marketing strategy establishment, and training. Technology commercialization is typically costly and time-consuming with very uncertain conditions.

4. The proposed model

This section proposes a model of patent portfolio and commercialization in R&D centers. The model is performed by taking 13 stages (the boxes exhibited in Figure 4). Thus, it is a sequential stage-by-stage procedure. In addition, each stage consists of several "items" to be considered. Thus, we can say that we deal with an itemized model. The items are those criteria, requirements, or tasks that the analyst should pay attention to or carry out. In what follows, the stages are described one by one.

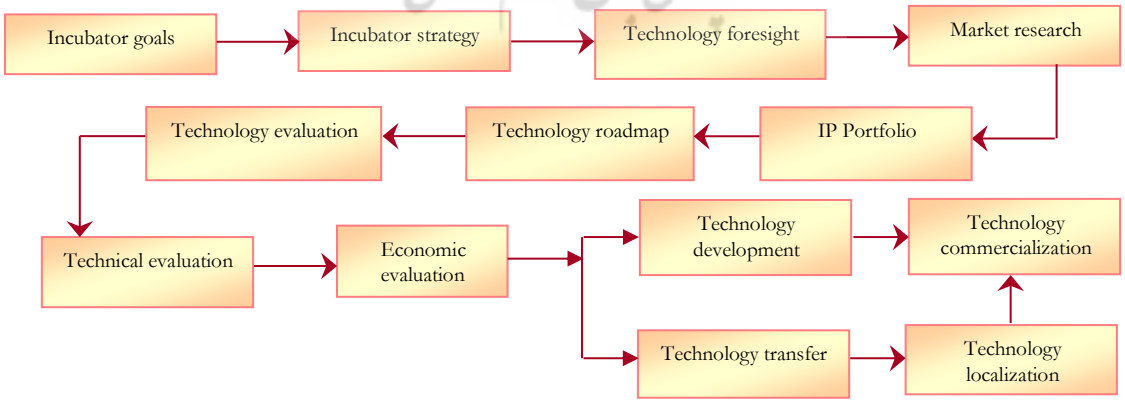

Figure 4

The proposed procedure, from setting incubator goals to technology commercialization

4.1. First stage

Primary goals of the incubator with considering the following items should be recognized:

- Are there enough goal statements of meaningful outputs?
- Are goals stated?
- Are goals achievable?
- Is there an approximate platform to make a model for writing statements of goals?
- Is there flexibility to vary the goals in a given plan?

4.2. Second stage

The definition of the incubator strategy has to be specified by considering the following items:

- Levels of strategy;
- Corporate strategy;
- Strategic business unit;
- Strategic business area (SBA);
- Functional strategy;
- Competitive strategy;
- Strategic management procedure;
- Environmental monitoring;
- Strategy setting down;
- Missions;
- Objectives;
- Types of strategies (corporate, business, functional);
- Policy;
- Strategic choice;
- Strategy implementation;
- Strategy evaluation and control.

4.3. Third stage

Based on future changes and customer requirements, the technology foresight with the following items is assessed:

- Systematic long-term view;
- Identifying generic methodologies/technologies;
- Economic and social yields;
- Providing adequate compliance with investigation objectives;
- Accessing the reasonable reliability of the expert's evaluations;
- Allowing experts to understand their knowledge;
- Do not neglect any individual expert's assessments;
- Making conditions for understanding the combined abilities of experts;
- Structural concentration for promotion tendencies.

4.4. Fourth stage

Market R&D is accomplished for the sake of defining the market penetration of the technology by taking the following items into account:

- Market structure evaluation;
- Explaining market environment;
- Recognizing economic and industry path;
- Measuring the size of the market;

- Recognizing market segments;
- Assessing market segment size, growth score, and competitive environment;
- Evaluating business powers for market share and competitive position;
- Recognizing competitor situations and positioning;
- Constructing customer needs for products;
- Recognizing potential market challenges;
- Recognizing market distribution channels;
- Recognizing product pricing attributes.

4.5. Fifth stage

The decision to create an IP portfolio based on the following items should be made:

- Number of patents;
- What patents do we have in our portfolio?
- Technologies;
- Strengths/weaknesses;
- Where should the company license technology to compensate for areas of weakness?
- Additional uses;
- Competitors;
- Competitors' strengths;
- How many patents do competitors have in their portfolios?
- Build on strengths or core competencies?
- Licensing-in factors;
- R&D factors;
- Licensing-out factors;
- Donation options;
- Lapse maintenance;
- Do these pose a threat?

4.6. Sixth stage

In this stage, we provide all the information needed for the roadmap design as follows:

- Reinforcing the start-up of the firm's specific procedures;
- Building critical connections between technology resources and business drivers;
- Recognizing significant gaps in market, product, and technology intelligence;
- Designing a first-cut technology roadmap;
- Reinforcing technology strategy and planning initiatives in the company;
- Reinforcing relationships between technical and non-technical roles.

4.7. Seventh stage

In this stage, the technology is selected based on different items as follows:

- Complete activities to identify relevant existent technologies;
- Technical study on different technologies;
- Economic study on different technologies;
- Financial study on different technologies;
- Political study on different technologies;
- Environmental study on different technologies;
- Safety study on different technologies;
- Risk analysis of different technologies;
- Application of decision-making methods for selection.

4.8. Eighth and ninth stages

After the selection of technology, it should be evaluated from technical and economic aspects:

- Goal and state of work (SOW) of the project;
- Sources of production supplies;
- Technical attributes;
- Schedules of net benefit and investment needs;
- Cost-benefit analysis;
- Financial road map;
- Assumption for implementation;
- Essenes and nature of the project;
- Setting of the project location;
- Supplies and competitive clients;
- Staffing requirements and sources;
- Physical, economic, and social characteristics;
- Regional, national, and international economic relevance to the project;
- Governmental policies and plans;
- Explanation of the issue statement;
- Sampling and survey methods employed to support the project;
- Form and quality of products or services;
- Projected overall demand in markets to be served;
- Projected competitive supplies and services;
- Sales potential and projected sales prices;
- Marketing program and projected marketing costs.

4.9. Tenth and eleventh stages

In these stages, the engineering of the technology becomes active, and technology transfer is started or decided, considering the following items:

- Studying technical/technological feasibility;
- Determining the implementation needs;
- Recognizing potential safety and environmental risks;
- Carrying out an initial production evaluation;
- Approximating engineering prototype costs;
- Recognizing materials, processes, components, and production stages;
- Examining materials and procedures;
- Designing and building a pilot platform or engineering prototype;
- Performing an initial production feasibility analysis;
- Optimizing the design tasks;
- Fulfilling required final tests;
- Providing engineering documents;
- Recognizing scale-up requirements;
- Establishing scale-up plans.

4.10. Twelfth and thirteenth stages

The technology should be localized and commercialized in these stages. The analyst has to take the following items into account:

- Linking a technology to a job to be done;
- Recognizing competitive options for using the technology;
- Recognizing major market segments;
- Recognizing unique and differentiated yields;

- Articulating a value proposition for a product;
- Possessing a comprehensive realization of the required value chain;
- Designing a cost model;
- Articulating the product concept in adequate detail;
- Characterizing the market for the product;
- Providing opportunities for growing fast enough;
- Recognizing the value chain;
- Defining an excellent way to obtain required relationships with value chain participants;
- Providing a comprehensive business plan;
- Submitting the business plan to potential resources;
- Characterizing the market for the product;
- Building a credible plan for obtaining the participation of critical value chain members;
- Having positive feedback relating to the functionality and value of the product;
- Starting to create sales to target users at or near projected prices;
- Articulating the sales/distribution strategy;
- Making the product ready for general release.

5. Applying the model

How can an analyst employ the proposed model to assess a real-life patent portfolio and commercialization case in petroleum incubators? This section suggests four approaches to answer this question.

5.1. Checklist

The analyst can make 10 checklists according to the 10 sets explained in the previous section. For a given set (e.g., the first stage), the checklist lists all the items the analyst needs to check to do or apply. Such checklists are management tools that list activities and behaviors that must be followed. When checking, each performed/applied item is assigned a tick mark; otherwise, we must answer/observe why that item has not been done.

5.2. Qualitative

This application considers a qualitative scale: “very low”, “low”, “medium”, “high”, and “very high”. Thus, for each item, a level from the scale is determined. Now, a strategy to control is used; for example, if a given item is measured at a medium or lower level, an action should be taken into account to increase the level.

5.3. Semi-quantitative

Semi-quantitative indicates assigning an ordinal numerical score such as 1, 3, 5, 7, and 9 to each item. In this case, like the qualitative method, corrective actions should be considered when the score is under a predetermined threshold. In addition, an overall score for the project can be calculated by summating all the individual scores. This overall score can be used to compare different projects or to measure this overall number with an overall threshold.

5.4. Quantitative

This form of analysis is a deep method to evaluate the project. In this case, each item is dedicated to a rate between 0 and 1 in a way that 1 depicts the best result/condition. After that, each item is assigned a numerical weight (between 0 and 1), indicating the proportional importance of the item over the others. Finally, a weighted summation of the rates is computed. This overall rate presents the level of the project’s success in the interval of 0–1. Like the semi-quantitative method, the analyst may use

thresholds (individual thresholds for each item and overall threshold for the project) to control the project.

6. Model validation

A Delphi evaluation has been performed as a validation of the suggested methodology. Four scientific meetings have been held with five experts with adequate knowledge and experience in the patent portfolio, commercialization, and petroleum incubators. It should be noted that these experts completely differed from the SMEs who participated in establishing the model. Each expert's meeting lasted about 3 hours. After thoroughly explaining the model and its components, the experts rated the model with a score from 0 to 10. In addition, they took its potential effectiveness and flexibility into account. The mean and the standard deviation of the scores were 8.25 and 1.12. Further, the experts expressed the reasons for their judgments. The significant notes expressed by the experts were as follows:

- The model is relatively comprehensive;
- It is well-structured and easily applicable;
- The model can be easily customized to be implemented in various situations;
- It needs many professional meetings.

7. Conclusions

Technology and IP management development must be intertwined to ensure success and viability. The high complexity of technology R&D, the need to develop global market strategies, the reduction of product life cycles, and broadening product portfolios require integrating IP management procedures and product development. Petroleum incubators can capitalize on the integrated IP management approach by combining state-of-the-art IP search and analysis tools and techniques.

This paper reviewed the related literature and observed no comprehensive, well-defined model. Thus, it offered a stage-by-stage itemized model for analyzing patent portfolios and commercialization in Iran's oil, gas, or petrochemical incubators. This model introduced the most efficient and effective way of developing the technology by using several items categorized in different aspects, including incubator goals, incubator strategies, technology foresight, market research, IP strategy, IP portfolio management, technology roadmap, technology evaluation, technical and economic evaluation, technology development, technology localization, technology transfer, and technology commercialization. In addition, four methods to employ the items in real-life situations were suggested. Future research can be undertaken to develop the suggested methods to employ the methodology in real-life situations. This recommendation refers to developing comprehensive and more applicable techniques in this area; for example, criteria weighting methods should be incorporated to estimate the weight of each item.

Nomenclature

IP	Intellectual property
R&D	Research and development
SBA	Strategic business area
SEM	Structural equations modeling
SME	Subject matter experts
SOW	State of work
TTO	Technology transfer office

References

Arasti, M.R. (2004). A Classification of Methods for Technology Auditing, Korea, PICMET.

Baghdadi, S., Khamseh, A., and Madani, H. (2022). Identifying and prioritizing technology commercialization components in the Iranian oil and gas industries, *Petroleum Business Review*, 6(4), 85–102.

Bergek, A., and Norrman, C. (2008). Incubator best practice: A framework. *Technovation*, 28(1–2), 20–28.

Braun, E. (1988). Technology in Context: Technology Assessment for Managers, Routledge.

Burdon, J. (2007). IP Portfolio Management: Negotiating the Information Labyrinth, Handbook of Best Practice, P. 1195–1201.

Chang, Y., and Cheng, Q. (2022). Entrepreneurial mentoring, financial support, and incubator patent licensing: evidence from Chinese incubators. *European Journal of Innovation Management*, 3(3), 1–16.

De-Esteban-Escobar, D., De-Pablos-Heredero, C., Montes-Botella, J.L., Blanco-Jimenez, F.J., Garcia, A. (2022). Business incubators and survival of startups in times of COVID-19. *Sustainability*, 14(2139), 1–15.

Gassmann, O. (2006). Intellectual property management in inter-firm R&D collaborations. *Taiwan Academy of Management Journal*, 6(2), 217–236.

Holgersson, M., and Aaboen, L. (2019). A literature review of intellectual property management in technology transfer offices: From appropriation to utilization. *Technology in Society*, 59(101132), 1–10.

Jamison, D.W., and Jansen, C. (2001). Technology transfer and economic growth. *Industry and Higher Education*, 15(3), 189–196.

Jobber, D. (2002). Principles and Practice of Marketing. McGraw Hill, 3rd Edition.

Khaill, T.M. (2000). Management of Technology: The Key to Competitiveness and Wealth Creation. Boston, McGraw–Hill.

Kotler, P. (2000). Marketing Management: Analysis, Planning, Implementation & Control. Prentice-Hall, 10th Edition.

Lerner, J. (1994). Venture capitalists and the decision to go public. *Journal of Financial Economics*, 35, 293–316.

Majidpour, M. (2017). International technology transfer and the dynamics of complementarity: A new approach. *Technol. Forecast. Soc. Chang*, 122, 196–206.

Maniyan, A., Khordad-Barmi, M., and Mohamadian, A. (2016). Designing the business model for virtual incubator in Iran. *Journal of Science & Technology Parks and Incubators*, 47(12) 1–11.

Matour, M., and Ameri, F. (2021). Interaction of intellectual property rights and competition law and the question of technology transfer in Iran's oil industry. *Petroleum Business Review*, 5(3), 53–60.

Panda, H., and Ramanathan, K. (1996). Technological capability assessments of a firm in the electricity sector. Technovation, 16(10), 270–285.

Pandey, N., De-Coninck, H., and Sagar, A.D. (2022). Beyond technology transfer: Innovation cooperation to advanced sustainable development in developing countries. *Wiley Interdisciplinary Reviews: Energy and Environment*, 11(2), E422, 1–25.

Pattanasak, P., Anantana, T., Paphawasit, B., and Wudhikarn, R. (2022). Critical factors and performance measurement of business incubators: A systematic literature review. *Sustainability*, 14(4610), 1–39.

Porter, M.E. (1985). Competitive Advantage: Creating and Sustaining Superior Performance.

Ravi, K.J., Andrew. O. Martyniuk, M.M., Harris, R.E.N. and Woldmann, K. (2023). Evaluating the commercial potential of emerging technologies, *International Journal Technology Transfer and Commercialization*, 2(1), 32–50.

Ricupero, R. (2003). How to Prepare Your Business Plan, Geneva: UNCTAD, 1st Edition.

Rothaermel, F.T. and Thursby, M. (2005). University–incubator firm knowledge flows: Assessing their impact on incubator firm performance. *Research Policy*, 34, 305–320.

Scott, S. (2001). Technology regimes and new firm formation, *Management Science*, 47(9), 1173–1190.

Teece, D.J. (2018). Profiting from Innovation in the digital economy: Enabling technologies, standards, and licensing models in the wireless world. *Research Policy*, 47, 1367–1387.

UNIDO. (2020). UNIDO Technology Foresight Manual: Organization and Methods. Vol. 1, Retrieved From Https://Www.Research.Gov.Ro.

Wang, C.K., Wang, K., and Lu, Q. (2003). Effects of venture capitalists' participation in listed companies. *Journal of Banking & Finance*, 27, 2015–2034.