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PSYCHOLOGICAL ASPECTS AND NUANCES OF PRODUCT MARKETING (Modern multidisciplinary digital technologies incorporating artificial intelligence and artificial neural network elements, together with the psychological aspects and nuances of marketing products developed on the basis of, and further advancing, these technologies)

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Abstract

This publication examines modern multidisciplinary digital technologies incorporating artificial intelligence (AI) and artificial neural network (ANN) elements, together with the psychological aspects and marketing principles associated with innovative products developed on the basis of, and through the advancement of, these technologies.

Particular attention is devoted to the integration and psychological adaptation of the Theory of Inventive Problem Solving (TRIZ) and the Algorithm of Inventive Problem Solving (ARIZ) to contemporary approaches to the commercialization of innovative products, high-technology projects, and digital solutions. The publication analyzes methods for evaluating the commercial potential of innovative products while taking into account the requirements of modern patent legislation, including the assessment of the non-obviousness of technical solutions as one of the fundamental criteria for patentability under United States patent law.

The publication investigates the influence of digital technologies, software systems, artificial intelligence, and artificial neural networks on the development, commercialization, market positioning, and legal protection of innovative products. It demonstrates that the increasing technological complexity of modern products requires the integration of engineering analysis with advanced psychological approaches to assessing innovation potential, market acceptance, and commercial viability.

Special consideration is given to the development of a comprehensive preliminary evaluation methodology based on a structured assessment framework consisting of 44 interrelated

evaluation criteria designed to analyze innovative ideas at the earliest stages of development. The proposed methodology enables the assessment of commercial potential, technological originality, market competitiveness, patent prospects, and the psychological factors influencing the perception and successful commercialization of innovative products.

The publication further emphasizes the necessity of adapting the classical principles of TRIZ and ARIZ to the realities of the modern innovation economy, where the success of a technological solution depends not only on its engineering originality but also on its commercial feasibility, intellectual property protection, market strategy, and psychological acceptance by potential users and investors.

The methodological approaches presented in this publication may be applied in the development, expert evaluation, commercialization, and strategic management of innovative products based on advanced digital technologies, artificial intelligence, and artificial neural networks. They may also serve as practical tools for specialists in innovation management, technology commercialization, engineering entrepreneurship, strategic marketing, and high-technology product development.

Keywords: *Digital technologies; multidisciplinary digital technologies; product marketing aspects; evaluation sheet components; the fundamental nature of all evaluation sheet elements; application of the Theory of Inventive Problem Solving (TRIZ) to enable personnel to generate innovative ideas and transform them into practical end results; the impact of artificial intelligence and artificial neural network elements on the optimization potential of monitoring and control systems; identification of non-obvious analogues of future inventions through comprehensive analysis of biological, biomedical, and other intelligent technological systems; biomimetic engineering approaches; biomechanical research; computer modeling; innovation methodology; intelligent technological systems; smart technologies; engineering innovation; digital transformation; systems engineering*

Introduction

Integration of the Algorithm of Inventive Problem Solving with Modern Commercialization Theories

At the time when the Theory of Inventive Problem Solving (TRIZ) was developed, it was widely believed that any qualified engineer or professionally trained specialist, provided with the methodological principles of TRIZ, could generate innovative ideas and successfully transform them into practical technical solutions. Owing to this prevailing perception, the newly developed methodology was rapidly accepted by the engineering and scientific communities.

For a considerable period, the fundamental principles, laws, and methods of TRIZ corresponded to the technological capabilities and engineering requirements of their time.

However, the rapid development of modern digital technologies raises a number of fundamentally important questions. What do these classical principles represent under contemporary technological conditions? How have advanced computing technologies and modern processor architectures influenced their integration capabilities? To what extent will the incorporation of artificial intelligence (AI) and artificial neural network (ANN) elements transform the optimization potential of intelligent monitoring and control systems? These represent only a small number of the questions requiring comprehensive scientific analysis.

One of the most significant contemporary trends is the systematic search for non-obvious engineering analogues within biological and biomedical systems, as well as within other intelligent technological environments. Modern biomechanical research, biomimetic engineering, and computer modeling increasingly provide the conceptual foundation for future inventions by revealing innovative technical principles derived from naturally occurring biological mechanisms.

These developments raise another important question: how can such approaches be effectively integrated with the established principles of TRIZ, ARIZ, and contemporary patent and licensing strategies?

Today, many of the most valuable and commercially promising inventions originate from discoveries inspired by living biological systems. These discoveries stimulate the de-

velopment of fundamentally new engineering concepts, unconventional technical solutions, and innovative technological methods that form the basis of intelligent engineering infrastructures and next-generation smart technologies.

Looking ahead, the introduction of quantum computers and their processor equivalents, integrated with artificial intelligence and artificial neural network technologies, is expected to substantially expand the scope, functionality, and application domains of intelligent technological systems.

The following sections present representative examples illustrating how integrated multidisciplinary concepts generate innovative technological environments characterized by non-obvious engineering solutions, the transformation of supersystems and interconnected subsystems, and the creation of fundamentally new technological architectures possessing a high degree of innovation and commercial potential.

Integration of the Algorithm of Inventive Problem Solving with Modern Commercialization Theories

The Theory of Inventive Problem Solving (TRIZ) and its subsequent Algorithms of Inventive Problem Solving (ARIZ) were developed during a period in which the commercialization of technological innovations received relatively little attention. At certain stages of their development, commercial considerations were intentionally subordinated to purely technological objectives, resulting in engineering solutions that were often detached from economic realities and practical market requirements.

As a consequence of this historical approach, many inventors educated within the classical TRIZ methodology became exceptionally skilled at generating technical innovations but remained insufficiently prepared for the challenges of commercialization, intellectual property management, competitive market environments, and innovation-based entrepreneurship. While they demonstrated outstanding creative abilities in developing new technical solutions, they frequently lacked the practical knowledge required to transform these innovations into commercially successful products capable of providing appropriate economic returns for their intellectual efforts.

For this reason, it is essential to evaluate not only the technological feasibility of an innovative idea but also the necessity of initiating the innovation process itself. Equally important is the ability to forecast multiple commercialization scenarios, assess market opportunities, and estimate the probability of successful implementation at the earliest stages of development.

To address these challenges, the author proposes the application of a comprehensive preliminary evaluation methodology based on a structured assessment framework consisting of 44 evaluation criteria. This assessment sheet is intended to facilitate the systematic analysis of innovative ideas by simultaneously considering their technological originality, commercial potential, patentability, market prospects, and strategic feasibility before significant development resources are committed.

Assessment Sheet Components

Each of the 44 components of the Assessment Sheet examines a specific aspect of an idea. The Assessment Sheet, available for download from www.prenhall.com/willitfly, is reproduced in Appendix IV. All calculations may be performed manually using a calculator or by entering the relevant values and formulas into an Excel spreadsheet. Each component is assigned a numerical score.

1. Urgent Unmet Need
2. Explainable Uniqueness
3. Sustainable Differentiation
4. Readiness for Immediate Demonstration
5. Good Competition
6. Bad Competition
7. Attractive Pricing Policy
8. Customers Willing to Purchase a Product That Does Not Yet Exist
9. Strength of Evidence of Demand
10. Staying Ahead of the Market
11. Ambush Strategy
12. “Hot” Market
13. Confidence and Fearlessness
14. Fulfillment of Commitments
15. Resilience
16. Passion
17. Management Competence
18. Integrity and Reliability

19. Ethics of Success
20. Attractiveness to Lobbyists
21. Available Cash
22. Revenue Exceeding Costs
23. Delivery Service Advantages
24. Availability of Resources
25. Market Leadership and Dominance
26. Market Penetration Strategy
27. Strategy for Crossing the Chasm
28. Intellectual Property Protection
29. Partnership Potential
30. Selection of the Right Location
31. Quality of the Contingency Plan
32. Unfair Advantages
33. Management of Capital Requirements
34. Limited Cash Requirements Prior to Business Launch
35. Visible Capital
36. High Potential Value
37. Predictable Results
38. Taboos
39. Showstoppers
40. Ostrich Syndrome
41. Connections with High-Flying Individuals
42. A Compelling and Persuasive Story
43. Connections with Government and Political Decision-Makers
44. The Path of Least Resistance, or Low-Hanging Fruit

Check that the spreadsheet functions correctly. Enter a score of 10 in every cell intended for the evaluation of an individual component. The total score should then equal 860.

Divide this figure by the weighted average score assigned to your idea in order to determine its overall rating. A result of 70 points or more is considered a passing score.

The degree of subjectivity and the role of intuition vary depending on the nature and subject matter of the idea being evaluated. The following sections examine the role of intuition, methods for evaluating and weighting individual components, and an additional method for applying the Assessment Sheet. They also explain what should be done when a particular component receives a low score, how calculations may be adjusted when a component appears irrelevant, how to maintain a realistic perspective, how to synthesize the scores, and how to address overlap – that is, situations in which two components cover the same underlying concept.

After reviewing the basic principles of assessment management, the discussion proceeds to a detailed examination of the individual sections represented by each component.

Examples of calculations are provided for every component so that readers can understand how it may be applied in real-world situations. From time to time, examples drawn from personal professional experience are also presented. The underlying assumptions are described in detail, although the names of the individuals involved have been changed.

Subjectivity and the Role of Intuition

At the earliest stage in the emergence of an idea, there is often a tension between objectivity and subjectivity. If you were completely objective, you might simply discard an idea that is, in fact, genuinely promising.

Objectivity may be regarded as part of the strategic planning process. Accordingly, the key to using the Assessment Sheet is intuition, which Webster's Dictionary defines as "the act or process of coming to direct knowledge or certainty without reasoning or inferring; immediate cognition." In an environment where research and objective analysis are highly valued, the possibility of applying an intuitive evaluation tool may appear particularly intriguing.

It should be emphasized that objectivity resulting from thorough research has an essential place in the decision-making process. At the same time, almost every major innovation began with a degree of subjectivity and intuition. General Motors, AT&T, Motorola, Procter & Gamble, and virtually every company included in the Fortune 500 began with little more than an initial insight or intuition – before the first automobile was sold, the first telephone call was made, or the first portable transceiver was created.

Unfortunately, the objective, or non-intuitive, approach to new ventures in corporate America may at times be excessively influenced by internal corporate politics. When large organizations attempt to launch a new business, rational analysis may, for one reason or another, be overridden by executive-level political considerations. A notable example is Motorola's experience with the Iridium project, a global satellite cellular

communications system. Professionals outside the company never regarded Iridium as a commercially viable project.

At the same time, many remarkable success stories are associated with less widely known organizations.

One particularly interesting example concerns the U. S. Navy submarine USS Scorpion (SSN-589), which sank on May 22, 1968. Six months later, it was discovered at a depth of more than 3,000 meters, approximately 400 miles southwest of the Azores. The submarine was located after several highly qualified experts in marine modeling and mathematics calculated its probable position by solving a decision problem formulated by John Craven, a civilian specialist engaged by the U. S. Navy to manage the investigation.

The experts reached a collective conclusion that a torpedo tube had been activated and that, in order to trigger the torpedo's internal engine shutdown mechanism, the submarine had changed course by exactly 180 degrees. Based on this collective assumption, the search team succeeded in locating the submarine only approximately 200 yards from the predicted coordinates. In this case, intuition contributed directly to solving the mystery.

Numerical Values in the Assessment Sheet

The following section describes two calculation methods used for each component. The first is referred to as scoring, and the second as weighting. Each business idea is assigned its own unique score, whereas the same component retains the same weight when applied to different ideas.

Scoring

The score ranges from +10 to −10. The first step is to determine whether the score should be positive or negative.

Ultimately, the evaluator is assessing the risks and benefits associated with a particular action or form of behavior. Although one may not consciously recognize it, this is something people do every day. For example:

- Is it worth spending additional time overtaking a slow-moving vehicle in order to move into the far-right lane of a motorway?
- Would I benefit from switching to a different cleaning product?
- Is it worth risking an expired parking payment?

In each of these situations, we compare the likelihood of success with the possible consequences of failure.

Another important consideration is the need to ensure that the assigned score is sufficiently well founded. A critical element of the intuitive approach is therefore an informed assumption based on relevant knowledge.

Sherry Sontag et al., *Blind Man's Bluff: The Untold Story of American Submarine Espionage*, Chapter 5, Thorndike Press, 2000.

A score may always be revised later if further reflection indicates that another value would be more appropriate.

How should each component be evaluated? We generally begin with a pass/fail assessment, using 7 points as the threshold value.

Does the component deserve a score higher than 7? If so, by how much? Does the idea merit 7, 8, or 9 points? Or is it sufficiently strong to receive a perfect score of 10?

Most readers are likely familiar with this type of scale, and the method should therefore be relatively easy to apply.

If the component fails to meet the required standard, should it receive 6 points? Or should the score be reduced to 5, corresponding to approximately 50 percent, or perhaps to 4 or 3? Should it receive a firm score of zero because it completely fails to satisfy the relevant criteria? Alternatively, does it possess some residual value that justifies a score of 1 or 2?

We assign a score of 1 or 2 to components that would otherwise merit zero but nevertheless retain some limited or appealing value.

In some cases, a component may be so weak – even in a project that ultimately becomes successful – that a score of zero is insufficient. In such circumstances, the component should be evaluated using the negative portion of the scale.

For example, Orion Satellite Corporation attempted to compete with the global Intelsat telecommunications cartel. The U. S. representative and access provider, Comsat, which held the exclusive right to operate through Intelsat satellites, charged approximately ten times the price of comparable domestic satellite services for essentially identical technology.

We believed that Orion would be able to provide better service at a significantly lower cost. However, approximately 130 countries were aligned against the company, and Orion therefore received an extremely low score for the component referred to as "Showstoppers."

In other words, the component was not merely somewhat weak; it represented a major obstacle and therefore required a negative score. If a component indicates an almost inevitable failure of the project, it should be assigned a score of –10.

The Orion showstopper example will be examined in greater detail later.

Weighting

Each component has its own specific **weight**, which must be multiplied by the assigned score. Weighting reflects the fact that certain components carry greater significance and are therefore more important than others.

Rather than providing an extensive description of a highly detailed weighting methodology, we adopted a simplified system and assigned each component one of three classifications: minimum, medium, or maximum weight. Components with minimum, medium, and maximum weight are multiplied by coefficients of 1, 2, and 3, respectively.

Because the Assessment Sheet is inherently intuitive, the weighting values reflect experience-based judgment. The weight assigned to a particular component remains constant for all ideas, whereas the score will naturally vary from one idea to another.

For example, whenever an urgent unmet need is evaluated, that component will carry a weight of 3, regardless of whether the project involves launching a new airline or developing a residential care facility.

Bonus Application

The Assessment Sheet may be used not only to evaluate the initial viability of a business venture but also, after several years of operation, as a diagnostic and adjustment tool.

As the entrepreneur gains experience and accumulates and synthesizes additional information, the Assessment Sheet becomes increasingly accurate. Ultimately, it represents a snapshot of perceived reality at a given point in time.

A more reliable assessment is therefore likely to result from a sequence of several such snapshots rather than from a single evaluation.

Individual Low Scores

No single component score should be considered so low that it automatically prevents a venture from moving forward. Low scores may be compared to a map of minefields across the business landscape. If the hazards are identified and neutralized, the project may still succeed, even when some individual scores remain low.

As noted above, Orion Satellite Corporation received the lowest possible score for the "Showstoppers" component. The company faced opposition from 130 countries united within an active and legally established cartel. Accordingly, the project received a score of –10 for this component, which, after applying the maximum weighting factor, resulted in a weighted score of –30.

Was this fatal to the project? Not at all. The company ultimately succeeded.

The essential requirement is persistence and the continued search for ways to improve weak areas. At some point, a component may reach an acceptable passing level.

The key indicator in Assessment Sheet analysis is therefore the total weighted score. The central question is whether the overall result can reach at least the passing threshold of 70 percent.

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