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A new integrated product and process development model

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Abstract. Currently, the demand for more robust, economic, and quality products has increased the complexity in the integrated process development and product design model. In the knowledge economy century, all nations are competing to innovate new technologies to develop a new system that produces goods in less time and cost with compatible quality. Hence, a new IPPD model is needed to offer support and information/ technology sharing during the entire product life cycle. The new IPPD model proposed that integrate all domains shall affect the product development. The model has a friendly computerized interface supported with internet enablers that offer support to the user to collect and share data easily. This model contains 6 domains. The Business Environment is the first domain, which analyzing the pre-feasibility of the product creation. The second domain is the market analysis and segmentation taking into consideration customer needs and competition. Managerial readiness of the product developing company is the third domain, including all managerial functions and the necessity of implementing the organizational change techniques if necessary. The fourth domain is Technological creation and deals with product concepts and robust quality design. Production/Launch is the fifth domain which consists of production processes and quality techniques to assure producing with the required quality and price levels. Finally, the sixth domain deals with the vital information of product distribution, maintenance and after-market service. The model is easily adapted to the industry need

1. Introduction

The product realization process and information integration are a major concern and prerequisite for competition in today's global market. Integrated Product and Process Development (IPPD) is associated with information integration to innovate and manage a new product/platform or improving an old one, through establishing a systematic and standardized system that applies innovation and improvements within particular steps. Information integration and cooperation are the basic aspects of a successful integrated model. Researches in business success among different organization and products have shown that number of factors are important to create a competitive product.

To establish a successful, and effective product and process development model not only avails to control the production process effectively but also to integrate all available information and inputs that will trigger product improvement.

Our proposed model encompasses these mutual relationships between the external forces drive the business, the market forecasting, and the organizational aspects with the production process technicality. Prior IPPD models were linear, such that the activities done in series with no integration, and not considering the international changes in developing products, neglecting its complexity and



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related needs for innovative ideas, concepts and new technologies in order to face competition and realizing the speed to market[1], the integration also allowed us to consider aspects have been neglected such as business environment, market, company strategy management. The global market nowadays depends on information integration, and to cope with it the product development system used must be integrated as well. Systematic, Coherence, flexible, and innovative. The concept of Integrated Product Development Process (IPPD) establishes an overview on each theme, as well as their relation to each other.

2. Methodology

Research articles and papers from scholarly journals, conferences, and reviewing references and books. The author studied the IPPD existing models, knowing each model's advantages and disadvantages and limitations then build a new integrated model that has a set of new domains and tools.

2.1. Integrated Product and Process Development

I.P.P.D provides a systematic approach to product development that achieves timely collaboration of relevant stakeholders through the product life cycle to better satisfy customer needs.

2.2 PESTEL Tool

The PESTEL tool is the most common approach for considering the external business environment [2]. PESTEL refers to P for political, E for economical, S for social, T for technological, L for legal, and E is for ecological. In the new model, it shall assist the user understand and configure the external impact on the business, and this tool is especially useful when starting a new business or making a new platform or introducing a new market.

2.3 SWOT Analysis

It is a tool used for strategic planning, it can be used effectively to build competitive strategies[3]. SWOT stands for strengths, weaknesses, opportunities, and threats.

3. Theory: The New Model

In Our Proposed Model the domains emanate from each other and the activities are not done in series, they are integrated together and allowing the necessary feedback. This model has 6 domains Each domain contains several activities, and the final model will help the user to understand the surroundings and their needs. The domains are:

- The Business environment
- The Market environment
- Managerial readiness
- Technological creation
- Production/launch
- Post Launch.

This paper focuses on the first three domains, as shown in figure 1.

3.1 Business Environment Domain

It is the external factors that affect the business. There is an unbroken relationship between the organization and the business environment, thus every business organization needs to react with its environment.

The organization's success or failure principally depends on the effectiveness of its interaction with the surrounding environment [4] explained that various restrictions are decreed in all organizations by the environment.

The readiness of the business environment will facilitate the decision of investing and the success of the project as shown in figure 2, and it contains 3 subdomains, PESTEL tool (external environment) as it is the most common approach for considering the external business environment. Resources evaluating and internal environment.

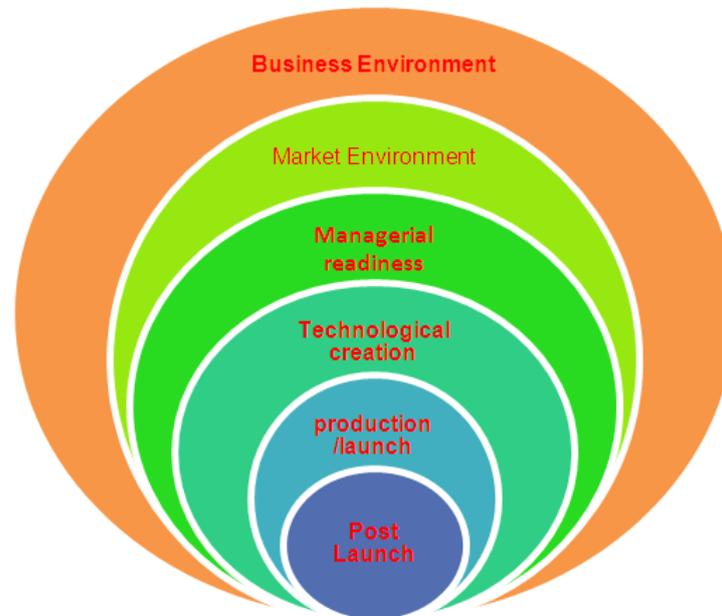


Figure1.New Proposed model six domainsoutline.

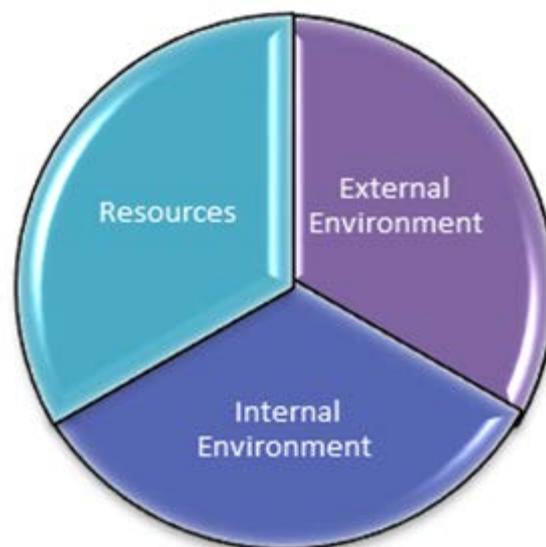


Figure2.Business environment three subdomains.

3.2 Market Environment Domain

Marketing term refers to the group of consumers or organizations that is interested in the product and has the resources to purchase it. The Market is permitted by regulations to acquire the product. In this domain, market research takes place to analyze the market need, know the demand, potential investors, Supplier integration[5], study the competitors and their strength and weakness points, also make the initial marketing plan with the help of the gathered information, finally collect the potential customers' needs and main concerns.

Market domain contains 7 subdomains so that market environment shall be covered from all aspects.

3.3 Managerial readiness

The third domain in the model helps in managerial readiness of the product developing company including all managerial functions. This domain is also necessary for implementing the new vision and organizational techniques if necessary. It contains 3 subdomains planning and company strategy[6]. Planning contains 3 steps as shown in figure 3.



Figure 3. Planning steps (help users to set up project goals).

4. Application

Our proposed model is consistent with the requirements of the economic century so we designed a user-friendly interface that interact and support the users need. The interface is supported by internet enablers and data entry pages to help the users in their research and the final decision[7]. The new model interface shown in figure 4 supported with internet enablers and programmed sheets which will help the users to enter the data into the program as well as lead them to follow the right procedure. As shown in figure 4 the model interface including the domains and subdomains icons, save and save as. By pressing any icon, another sheet or chart or internet link will be opened in certain procedures.

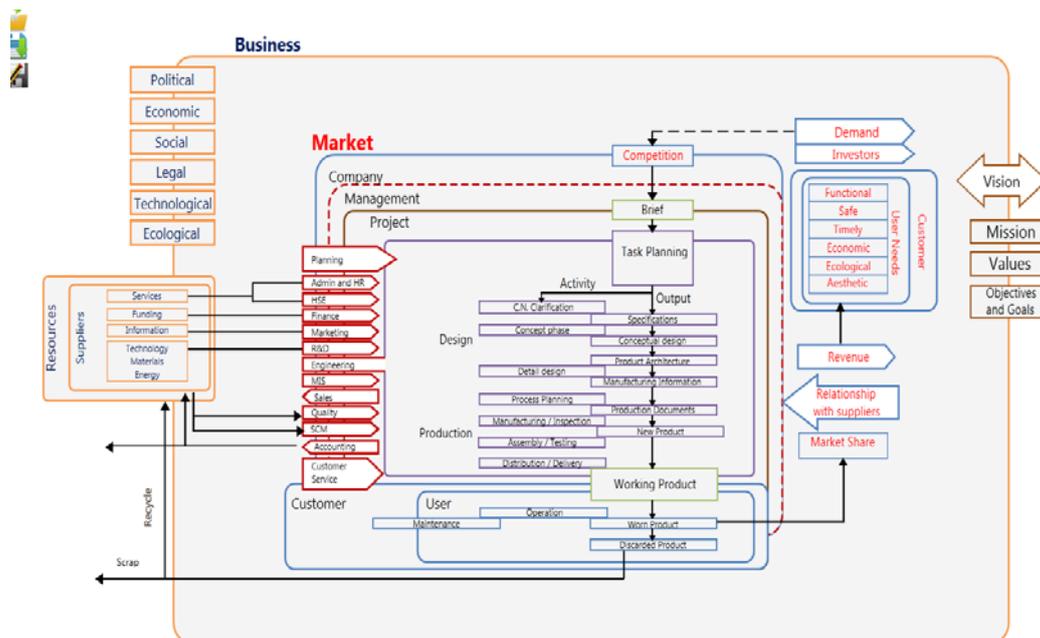


Figure 4. The new model program.

At first, the business domain, which include the PESTEL tool that contains of 6 external factors each factor listed inside the parameters effect on it and some linked to internet enablers,as shown in figure 5.Example,If the user press on Tariffs, the user will be transferred to the Egyptian ministry of finance / Tariffs section. So that the user can know all what is need and be aware of any changes happened in the tariffs.

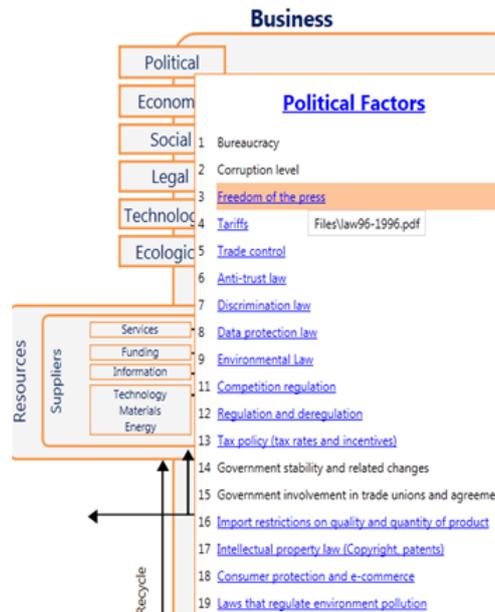


Figure 5. PESTEL tool drop-down menu.

After studding those parameters, a questioner for each factor must be done as shown in figure 6.

Figure 6. Political analysis questioner.

After studying the PESTEL factors and answering the questioner, the user press Business icon then a new sheet appears in it (SWOT/PESTEL analysis) table and the user has to rate each slot from 0 to 10 and the programe will have coloured those slots, green for go and red for risk. This step should help the user in his decision, figure 7.

SWOT \ PESTLE	Political	Economic	Social	Technological	Legal	Environmental
Strengths	7	8	5	10	4	3
Weaknesses	3	3	6	9	8	5
Opportunities	5	2	3	3	9	10
Threats	3	5	3	5	6	8

Figure 7.SWOT/PESTEL analysis.

Now, the internal environment section, which contains of 4 parts that the enterprise should create, they are vision, mission, values, objectives and clear goals and millstone[8].As in figure 8.

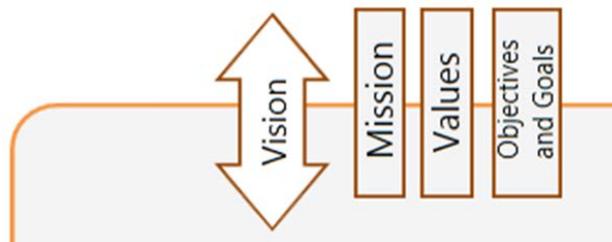


Figure 8.Internal environment.

Each slot linked to another page that allowed the user to write down the data.For example, mission is shown in figure 9.

MAIN WINDOW

Mission

Mission

Project Mission Statement

Product Description

Benefit Proposition

Key Business Goals

Figure 9.Mission statement window.

The 3rd subdomain is resources availability, and it 15 questions about the raw material, energy resources, and the services availability. The user shall study the availability with the help of internet enablers then rank them from 0 to 5. A pie chart will appear showing the availability percent, as shown in figure 10.

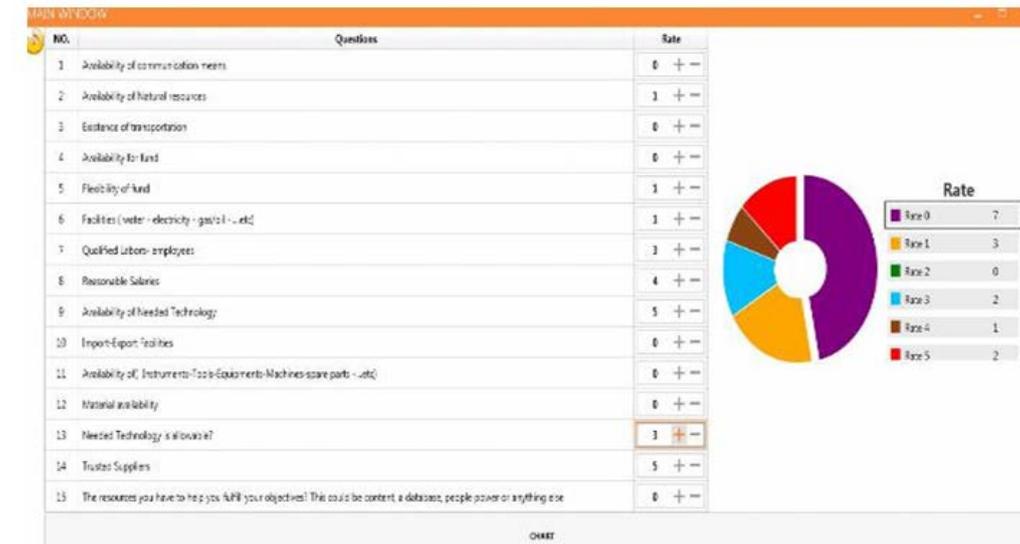


Figure10.Resources and services availability.

The 2nd domain “market domain” contains of 7 subdomains as shown in figure 11. Each subdomain contains activities. If user press any icon another window will open that contains helping internet enablers and links, also contains a questioner that user can answer it using the links or via other methods.

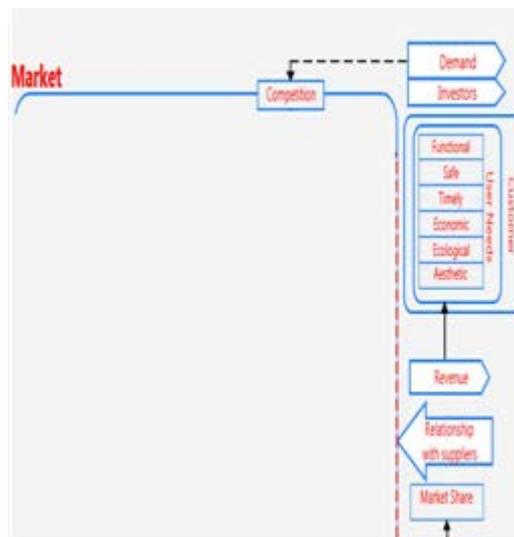


Figure 11. Market environment 7 subdomains

For example, potential investors subdomain that shown in figure 12 and figure 13. The 3rd domain is Managerial readiness, it contains 2 subdomains, Planning and Organizational Structure.

START WINDOW

2. Are there any investors in the country may want to invest with us?

3. How many startup projects in the last year?

4. Is there any potential investors? Mention them.

5. Is there flexibility in taking foreign investment?

Helping Sites

Content	Link
Global Conference on IoT, Towards a More Connected World	https://gpciot.org/
A list of Egyptian startup investors	https://www.wamda.com/2016/09
Cairo Angels is Egypt's first formal angel investment network, investing in and supporting early-stage startups in Egypt	http://cairoangels.com/

Figure 12.potential investors window that contains a questioner and helping internet enablers

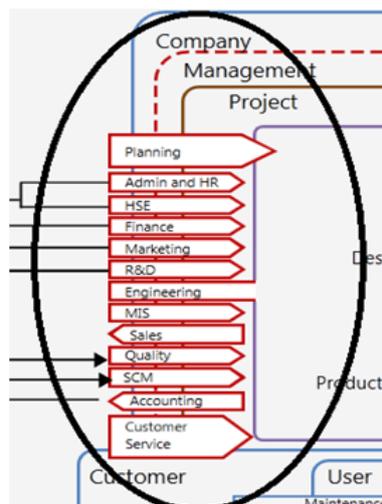


Figure 13. Managerial readiness domain

For example, planning subdomain that contains 3 steps as in figure 14

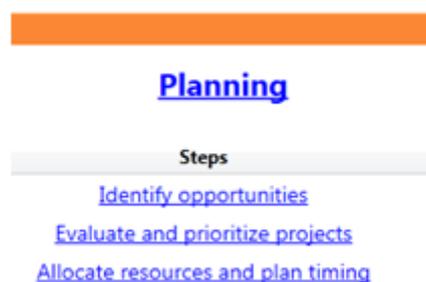


Figure14.planning subdomains window

Allocate resources for example the user allocates the facilities and resources for each quad as in figure 15.

MAIN WINDOW															
Projects	Quad1				Quad2				Quad3				Quad4		
	Resource1	Resource2	Resource3	Resource4	Resource1	Resource2	Resource3	Resource4	Resource1	Resource2	Resource3	Resource4	Resource1	Resource2	
Project1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Project2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Project3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Project4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Resource Demand	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Resource Capacity	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Capacity Utilization	0 %	0 %	0 %	0 %	0 %	0 %	0 %	0 %	0 %	0 %	0 %	0 %	0 %	0 %	

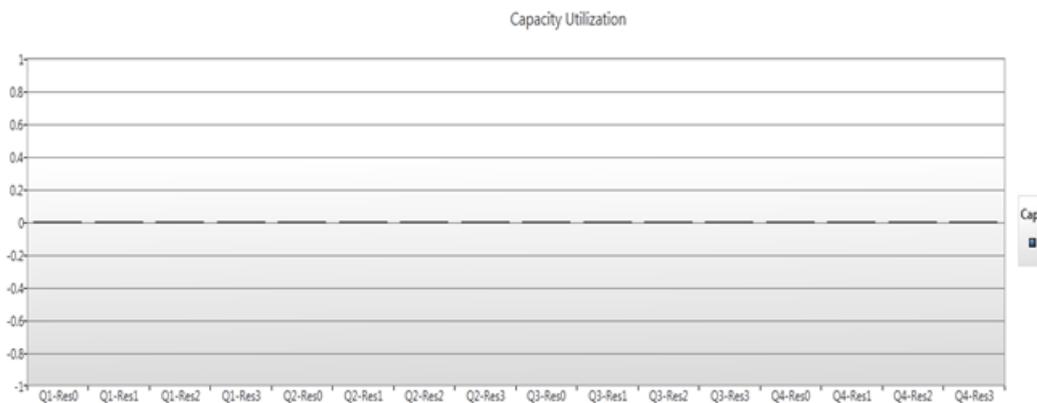


Figure 15. Allocate resources table

After finishing the first three domains a decision must be taken to continue in this project or not. If the project will be continued, then proceed in the rest of the model domains. The New IPPD Model has a friendly interface that the users can deal with easily and smoothly, the user can save as many as projects he wants. This model will help in managing and development of the entire process.

5. Conclusion

The findings of this paper are:

- 1) A common challenge in the product, process modelling, and tried to simulate the information integration era.
- 2) Our findings have important implications for entrepreneurs and managers who want to introduce a new product, improve old one, or even enter a new market.
- 3) Our proposed model encompasses all the domains that will affect the project success, taking into consideration the variation between industries segments and their needs, the model is Taylor made such that it is flexible and can be adapted.
- 4) By using this model Entrepreneurs will be able to decide when and where they will establish their projects, as they will scan the business environment and forecast the market need, turning those needs to a reliable design with competitive characteristics. Such information will have impact on the entrepreneur’s decision.
- 5) Finally, our study also highlights two important aspects:

- The importance of simulate the reality and let the model be integrated with activates emanate from each other not done in series
- The importance of take into consideration, the external forces that drive the business and emphasize the criticality of the information integration within the organization and how to manage them.

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