Product Lifecycle Management (PLM) Model in a Service Industry: Service Lifecycle Management (SLM) Model

Mune Moğol Sever*

Öz

Purpose: *The previous global health crisis prompted businesses to undertake the process of digitizing their operations. The recent epidemic had a significant impact on both the manufacturing and service sectors. The ongoing global pandemic caused by the novel coronavirus, SARS-CoV-2, commonly the limitations and restrictions around remote working compel organizations to seek out appropriate digital technology. Product Lifecycle Management (PLM) is a comprehensive solution that aids organizations in effectively overseeing the entirety of their supply chain, production, and operational processes, encompassing all stages from initial design to end-of-life, through digital technologies. The objective of this study was to build a Product Lifecycle Management (PLM) - -based Service Lifecycle Management (SLM) model for effectively managing supply chain operations, specifically focusing on activities related to ordering and material supply for individualized products.*

Method: *The methodology employed in this research endeavor facilitates the comprehensive storage of individualized data. In this particular case, the initial step involves the collection of tailored product data. The data required for the preparation and serving of the tailored product are obtained through system analysis. During the process of system analysis, data about the material supply operations were gathered by utilizing and reviewing various forms and papers, as well as conducting an in-depth examination of the associated processes. The data obtained from system analysis facilitated the creation of tables, the establishment of relationships between these tables, and the development of relational databases that are the focus of this study. The approach has been deployed and evaluated within a service-based company.*

Findings: *The study has successfully developed a model and database that enable the execution of crosstab queries about consumer preferences, product information, material information, bill of materials (BOM), and supply information. Therefore, it is feasible to obtain digital data quickly, encompassing various aspects such as product specifications, service, and preparation duration, bill of materials (BOM), supplier details, supply information, lead time, and other relevant information for a customized product. The product and material listings have been organized and presented in the form of a cross-tab query within the established database.*

Implications: *The implications of this phenomenon are significant. By utilizing the methodology established in this research, it becomes feasible to convert manual and modular activities into a digital environment. By utilizing a sophisticated model, users can remotely and quickly achieve and control the entire process. The key outcome of this study is the acceptance of transforming the process into a digital ecosystem. Therefore, the utilization of the created model can help to eliminate the complexity associated with manual tasks.*

Originality: *The proposed paradigm facilitates the transition of manual and modular operations into a digital ecosystem. Therefore, by utilizing the model, the activities performed through traditional means are transitioned into a digital environment, allowing users to access data promptly. The model that has been developed is innovative in its approach to digitizing the operations of service-based organizations during the era of digital transformation.*

Keywords: *Product-Service design, Product Lifecycle Management (PLM), Service Lifecycle Management (SLM), personalization, digitalization.*

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Recieved : October 19, 2022 *Accepted: September 3, 2024*
Type : Research Article

Hizmet İşletmeleri İçin Ürün Yaşam Döngüsü Yönetimi (PLM) Modeli Tasarımı: Hizmet Yaşam Döngüsü Yönetimi (SLM) Modeli

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Öz

Amaç: *Son pandemi, işletmeleri, süreçlerini dijitalleşmeye zorlamaları yönünde tetikleyici olmuştur. Pandemi koşullarından, imalat işletmeleri kadar hizmet işletmeleri de etkilenmiştir. Özellikle uzaktan çalışma koşulları, kısıtlamalar hizmet işletmelerini uygun dijital teknoloji arayışlarına itmiştir. PLM, işletmelere tedarik zincirlerini, üretim ve tüm operasyonlarını tasarım aşamasından ürün yaşam döngüsü bitimine kadarki süreçte dijital ve eşzamanlı olarak yönetmelerine yardımcı bir araçtır. Bu çalışmada, sipariş verme, malzeme temini vd tedarik zinciri operasyonlarını yönetmek üzere, kişiselleştirilmiş ürünler için PLM tabanlı SLM modelinin geliştirilmesi amaçlanmaktadır.*

Yöntem: *Çalışma kapsamında geliştirilen model, kişiye özel verilerin depolanmasına olanak verecek şekilde tasarlanmıştır. Bu kapsamda öncelikle kişiye özel ürün tasarım bilgileri toplanmıştır. Bu ürünlerin üretim ve sunumunu gerçekleştirmek üzere hangi malzeme ve materyallerin gerekli olduğu bilgisine işletmede yapılan sistem analiziyle ulaşılmıştır. Sistem analizinde işletme içi malzeme tedarik operasyonlarının gerçekleştirilmesinde kullanılan doküman, formlar ve süreçler yerinde incelenmiştir. Sistem analizi aracılığıyla toplanan verilerle ilişkisel veri tabanı tabloları oluşturulmuştur. Model bir hizmet işletmesinde uygulanmış ve test edilmiştir.*

Bulgular: *Geliştirilen ilişkisel veri tabanı aracılığıyla, müşteri ürün tasarımı-tercihleri, ürün bilgileri, malzeme bilgileri & malzeme ihtiyaç listesi (Bill of Material-BOM) ve tedarikçi bilgilerine ilişkin çapraz sorgulamalar yapılması mümkün hale gelmiştir. Böylece tasarımı müşteriye ait olan bir ürün için ürün bilgileri, servis şekli, hazırlama süresi vb. içeren bilgilere ilave olarak malzeme ihtiyaç listesi ve bunların hangi tedarikçiden ne kadar sürede temin edileceğine ilişkin anlık ve dijital ortamda her türlü veriye erişim sağlanmıştır. Ürün bilgileri ve bunlara ilişkin malzeme ihtiyaç listelerinin çapraz sorgulamalarla tek tabloda görüntülenmesi olanaklı hale gelmiştir.*

Sonuç: *Çalışma kapsamında geliştirilen modelle, işletme içerisinde manuel ve parçalı yürütülen operasyonların dijital ortama aktarılması olanaklı hale gelmiştir. Model aracılığıyla, tüm süreç anlık olarak, kullanıcıların erişimine açık ve uzaktan izlenebilir ve takip edilebilir olmuştur. Tüm sürecin dijital ortama aktarılmış olması çalışmanın en önemli çıktısıdır. Böylece manuel operasyonlarda yaşanan karmaşa ortadan kaldırılmıştır.*

Özgünlük: *Önerilen modelle manuel ve dağınık olarak yürütülen süreç dijital ortama aktarılmıştır. Böylece geleneksel yöntemlerle yürütülen süreçlerin dijitalleşmesi ve verilere anlık erişim sağlanmıştır. Geliştirilen modelin, dijital dönüşümün yaşandığı dönemde hizmet işletmelerinde süreçlerin dijitalleşmesine olanak vermesi bakımından orjinal olduğu düşünülmektedir.*

Anahtar Sözcükler: *Ürün-hizmet tasarımı, Ürün Yaşam Döngüsü Yönetimi (PLM), Hizmet Yaşam Döngüsü Yönetimi (SLM), kişiselleştirme, dijitalleştirme.*

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Geliş tarihi : 19 Ekim 2022 *Kabul Tarihi: 3 Eylül 2024*
Makale Türü : Araştırma Makalesi

Introduction

Product Lifecycle Management (PLM) refers to the comprehensive management of a product over its entire lifecycle, encompassing all stages from its inception to its eventual disposal. According to Stark (2020PLM serves as a means to effectively manage the dissemination of information about products, processes, design, and other relevant aspects within the appropriate temporal and contextual parameters (Ameri & Dutta, 2005). PLM facilitates the comprehensive and integrated management of an enterprise's supply chain, production processes, and all associated operations, spanning from initial design to the final stages of the product's life cycle. This management approach is executed digitally, enabling efficient coordination and control across the product lifecycle. It is widely acknowledged as the primary instrument for digitalization in the context of Industry 4.0 and the subsequent period following the COVID-19 pandemic.

PLM encompasses the various stages involved in the innovation production, operation, administration, and retrieval of information about a distinct product. The PLM can be a valuable tool for updating product information across all stages, particularly in the service business where standards may be lacking (Golovatchev & Budde, 2007).

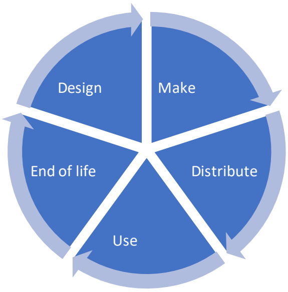

Figure 1: PLM elements

Designing serves as the initial component of the PLM process as depicted in Figure 1. Following the design phase, which encompasses products from both the manufacturing and service sectors, the subsequent stage involves the actual production or making of the product. Another subsequent stage following the process of production is distribution.

During the distribution phase, the product reaches a state where it is prepared for consumption or utilization. Once the product is prepared, the consumer is likewise prepared to utilize it. Once the product has reached the end of its lifecycle, it will be removed from the market.

PLM aids organizations in effectively managing the diverse range of products they offer. This is achieved through the visualization and restoration of product information, which in turn facilitates efficient product change management. Additionally, PLM enables enterprises to govern the flow of information and simplify data administration during the storage, creation, distribution, and use stages of the product lifecycle.

The concept of "end of life" refers to the final stage of an entity's existence, wherein it ceases to function or operate. In the context of design, "end of life" pertains to removing the product from the market.

In PLM, the data was collected from the initial stages, in the design phase (Aram & Eastman, 2013), One essential requirement in a digital production environment is the presence of specific needs.

The manufacturing paradigms saw significant transformations starting from the year 1850 as shown in Figure 2. As emerged in the year 1850s, craft production focused on the creation of custom-tailored products. In the following years, mass production became prevalent around 1913. Subsequently, lean production practices were introduced. The concept of mass customization emerged in the 1980s as a means of addressing the growing demand for personalized products and services.

Figure 2: The paradigm changes in manufacturing

The era of mass production succeeds craft manufacturing, influenced by both the surplus of demand and advancements in technology. Mass production is contingent upon the utilization of standardized items and established regulations, whereas mass customization relies on the utilization of products that can be configured according to individual preferences. The concept of personalization is based on the creation of distinct products and active client engagement throughout each stage of the production process.

The integration of digital elements and social media into everyday human life has led to the transformation of Cyber-Physical Systems (CPSs) into Cyber-Physical Social Systems (CPSSs) during the Industry 4.0 and 5.0 (I4.0 and I5.0) period (Yilma, Naudet, & Panetto, 2019). The concept of personalization has emerged within this aforementioned digital ecosystem. The advent of the internet and digital tools has facilitated widespread connectivity, enabling individuals to engage in a shared economy by exchanging ideas, expressing requests, and collaborating on designs. Therefore, customers, in their capacity as system users, are also allowed to participate in the first stages of PLM, namely in the design phase.

In the current era of personalization, the lifecycle of products tends to be very short, while conventional methods of production and marketing lack the necessary competitive continuous operations. The utilization of manual orders, manual papers, and distinct processes cannot ensure the survival and contemporaneity of a company. The pace of consumer expectations is undergoing rapid transformation. This refers to the development of novel items and procedures that are specifically tailored to meet individual demands. Under these circumstances, it is not feasible to sustain the ongoing procedures. In this scenario, the provision of comprehensive solutions and adaptability to evolving organizational requirements necessitate the implementation of digital management and monitoring systems.

The primary objective of personalization is to achieve value difference. Customer interaction is initiated at the inception of the manufacturing process. Given that each consumer has a distinct product. According to Mourtzis and Doukas (2014), the active participation of customers is crucial during the design phase. Each customer signifies the importance of product diversity. To achieve success within a large-scale data environment, businesses must adopt a digital solution. The utilization of a PLM solution enables the effective management of extensive documentation and the digital updating of large datasets. This study aims to establish a new PLM database for a service organization, utilizing individualized data.

The objective of this study is to develop a PLM model specifically tailored for the service industry, with a focus on Service Lifecycle Management (SLM). The primary focus of this study is centered around the principles of personalization throughout obtaining customer demand. Similar to PLM, SLM operations commence with the design of the product or service. Consumer demand serves as the primary catalyst for initiating the processing of both SLM and personalization.

The previous pandemic has demonstrated the necessity for service-oriented organizations to implement digitalization strategies through the adoption of digital technologies. One suitable tool in this particular scenario is PLM. The research employed principles of PLM to facilitate the digitalization of ongoing activities within organizations. This study develops a model framework and constructs a database to encompass the entire lifecycle. The database that was developed using Microsoft Access is shown in the subsequent sections, which provide a summary of the tables and their corresponding relationships. The model underwent testing, and the findings indicate that the suggested database can effectively retain all individualized information about consumer demand. Additionally, the findings indicated that the entire production process, from the initial design phase to the final stage, was examined. Additionally, the present study undertakes a comprehensive review of existing literature to synthesize and analyze the current state of knowledge on the chosen subject.

Literature Review

PLM can offer precise and tailored product services, hence enhancing the accuracy of production output. Additionally, it contributes to the improvement of product design quality and innovation. PLM can manage the workflows of the relevant units within the scope of authority and responsibility during the stages of goods and service production (Ötleş et al., 2015). Moreover, PLM exhibits the ability to seamlessly integrate with various information technology (IT) systems within companies, thereby facilitating the process of digitizing processes. The aforementioned attributes represent the benefits of PLM; nevertheless, they also include the generation of substantial amounts of data. Therefore, scholars have underlined the significance of implementing rules and principles related to big data (Li et al., 2015).

Some scholars describe research on PLM in service industries as SLM (Wiesner, Freitag, Westphal, & Thoben, 2015). Wiesner et al. (2015) elucidates the bidirectional nature of the relationship between PLM and SLM.

The usefulness of PLM or SLM in addressing the intricacies of product architectures, particularly in the aerospace industry, has been the subject of scholarly investigation (Mas, Arista, Oliva, Hiebert, & Gilkerson 2021; Cantamessa, Montagna, & Neirotti, 2012).

While PLM is commonly used in the context of new product development, it also found application in the maintenance, repair, and overhaul (MRO) processes of aircraft. In their study, Lee et al. (2008) demonstrate the practicality of PLM in the context of aviation Maintenance, Repair, and Overhaul (MRO) operations. This is achieved through the examination of two specific case studies.

The integration of PLM and value chains has been successfully applied in the LCD production industry, namely in the make-to-stock (MTS), build-to-order (BTO), and configuration-to-order (CTO) business models (Chiang & Trappey, 2007). This study examines the frequency of PLM usage. The findings indicated that the utilization frequency of PLM modules was high for BTO.

Mas et al. (2021) propose the use of PLM generation 3 as a means to address the challenges associated with the inflexibility and complexity of 3D solid modeling, integration with a digital twin, and the improvement of End-to-End (E2E) digital integrity.

The construction industry is a multifaceted sector that encompasses both service and production components, characterized by a wide range of products, materials, and consumer preferences. In their study, Min et al. (2012) introduced a conceptual framework that pertains to PLM within the construction sector.

Healthcare is another significant sector within the service business. The COVID-19 pandemic has witnessed a significant rise in the prominence of Internet of Things (IoTs) applications, particularly those on the Internet of Medical Things (IoMT). These apps have played a crucial role in facilitating remote control and diagnostics in the healthcare sector.

The importance of battery charging has become paramount. Sodhro, Pirbhulal, and Sangaiah (2018) conducted a study on this particular subject utilizing PLM as their research approach. Academic researchers endeavored to establish control over the transmission of information between devices through the integration of IoMTs and PLM systems.

Agile prognostic and diagnostic systems necessitate concurrent engineering as a simultaneous solution. In the fields of pharmaceuticals and chemistry, the implementation of a monitoring system necessitates the incorporation of mistake-detection mechanisms and corresponding solutions in a simultaneous manner. Researchers explore the feasibility of implementing PLM for an intelligent system, as discussed by Venkatasubramanian (2005). The researchers devised a process hazard analysis model to enhance the effectiveness of PLM.

The production procedures of drugs are also characterized by their complexity and iterative nature. During the ongoing production and testing phases, it is imperative to examine the indications and effects and incorporate the resulting findings into the processes as valuable information. Researchers explored the potential for integrating PLM into the medication manufacturing process (Kang, Chung, Langer & Khademhosseini, 2008).

The study conducted by Pinna et al. (2018) demonstrates the practicality of PLM in the context of New Product Development (NPD). Academic researchers explore the alignment of PLM processes and NPD (processes within the context of the food business. The findings of the study indicate that PLM has a beneficial impact on the capacity of enterprises to manage NPD and procedures. An additional finding from the aforementioned study indicates that the installation of PLM has a direct and favorable effect on a company's ability to coordinate activities, specifically in terms of enhancing NPD performance. While it is acknowledged that PLM can have a beneficial impact on a company's overall performance and its ability to manage processes, it has been noted that PLM may not apply to every stage of NPD.

Bungau, Bungau, and Tit (2015) aim to address the issue of waste in pharmaceutical products by utilizing PLM strategies. The researchers directed their attention towards the phase of PLM known as the End of Life (EOL) stage. The waste collection and recycling of pharmaceutical items was acknowledged and accepted by the relevant authorities.

The primary use of PLM is predominantly found in the manufacturing sector, as opposed to the service industries. There are some attempts to relate the PLM with carrying capacity on a destination scale (Birsen, 2017) but tourism studies still infancy in the PLM and SLM perspectives. The existing body of research on PLM in the service sector primarily focuses on the medical and healthcare domains, with limited attention given to the food business.

Methodology

The present study will employ a rigorous methodology to investigate the research question at hand. This section will outline the specific procedures and techniques that show PLM implementation in a service industry.

The study involved the storage of individualized data in a database that was specifically designed for this purpose. The decisions and desires of individuals might vary significantly and result in the generation of large volumes of data. To effectively administer the system, a database was created in collaboration with individuals from the service and operational departments of the firm under investigation.

Model framework and data collection

Study based on personalized data and developing a database. In order to store & restore those big data the new database was created. The ontology of database in this study is showed in Figure 3.

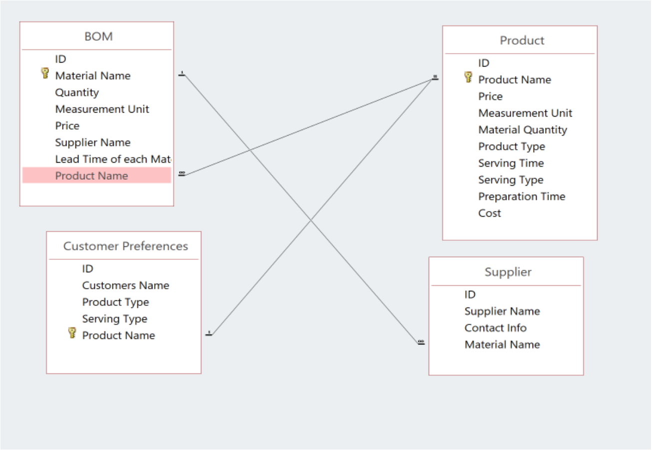

Figure 3: PLM Database Structure, Tables and Relations

The database utilized in this study encompasses the entirety of the choices made by customers, as well as their associated information. In addition to the aforementioned data, the database also encompasses supplier information and the Bill of Materials (BOM). As depicted in Figure 3, the tables of databases are enumerated below:

- BOM- Bill of Materials
- Product
- Customer preferences
- Supplier.

The BOM, also known as the Bill of Materials, is a comprehensive document that outlines the components, parts, and materials required for the production or assembly of a product. The three key elements of BOM under consideration are the product, customer preferences, and the supplier. A BOM is a concise inventory of the necessary materials required for the production of a particular product. The BOM table utilized in this study encompasses the following data: material name, amount, measurement unit, price, supplier name, lead time for each material, and product name information. In addition, the BOM table incorporates essential details such as material information, product name, price, and supply information, including supplier name and lead time. These elements are included to facilitate the establishment of a relational database.

The aforementioned item constitutes an additional table within the proposed database. The main information stored in the Product table includes the product name, price, measurement unit, material quantity, product kind, serving time, serving type, preparation time, and cost.

The research entails the collection of individualized data within a database, employing a customer preferences table as the primary framework. The primary components of the customer preferences table include the following: customer name, product type, serving type, and product name.

By implementing PLM, the organization has successfully achieved comprehensive monitoring of the whole lifecycle of its products or services, spanning from end to end. To comprehensively track the entire lifecycle, the supplier information has been incorporated into a database that has been constructed. Therefore, the final table formed within this database is the Supplier table. The supplier table provides the user with access to the provider's name, material name, and contact information.

By utilizing a computer-generated database, the organization can effectively oversee the entire lifecycle simultaneously and digitally. The process of determining the structure and organization of tables, as well as the relationships between them, was conducted through system analysis within the firm during the time of 02.06.2022-08.07.2022. This system analysis will involve direct observation of the entire supply chain process, specifically focusing on purchasing and material ordering. The model will be developed within these specified conditions.

Steps of the study

The primary objective of this study is to develop a comprehensive model for transitioning manual processes into a digital ecosystem and effectively monitoring all operations simultaneously. To ensure the continuity of operations, it is imperative to initiate the creation of a BOM. This phase involves comprehending the intricacies of material flow and management, purchasing orders, and supply chain activities. Additionally, it is crucial to get insight into the existing dynamics of supplier relations. This study will analyze purchase orders, material usage, and supply information, including lead time, quantities, and related forms and documentation. Furthermore, the firm under investigation will be subjected to direct observations utilizing the concepts of system analysis.

This study focuses on the development of a relational database to support the supply chain processes under investigation. The inclusion of tables and figures is essential in academic writing since they provide visual representations of data and information. These visual aids help to enhance the understanding and interpretation of the content presented in the text. The creation of relationships between tables is necessary for the storage of personalized data.

The procedures of the investigation were succinctly outlined in a graphical representation known as a flow chart. Diagram 1 presents the flow chart illustrating the investigation.

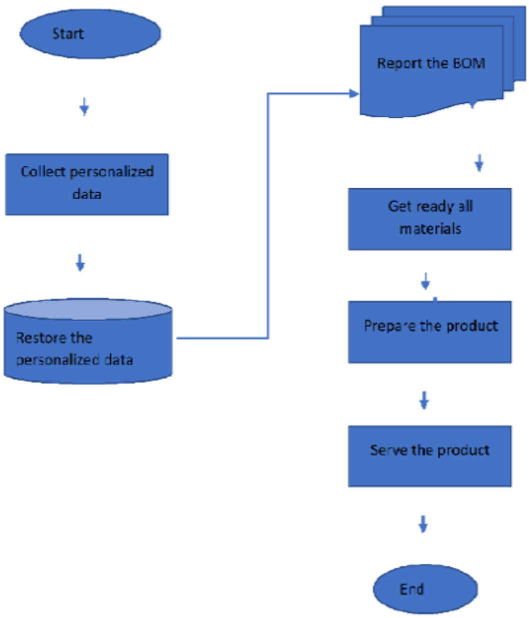

Diagram 1: Flow chart for the model structure

The initial phase of the research involves the collection of individualized data about a certain product. The suggested database is designed to capture and preserve personalized data.

The BOM for the customized product will be generated in the event of customer selection. The BOM serves as a catalyst for initiating the various operations within the supply chain. To prepare the product, it is necessary to collect all the inputs that are dependent on the BOM. As seen in Diagram 1 after the completion of material preparation, the product can be readied and served.

Customers can access their choices and information through a well-developed database at any given time. Upon consumers inputting customer options, such as designs created by prosumers, the data is subsequently kept within the database. Therefore, when clients visit the enterprises, the service provider can get pertinent data from the database and make necessary preparations for the desired product. Additionally, the user can access comprehensive information, including details about suppliers, lead time, preparation time, kind of service, BOM, and other relevant recorded data.

Once the customer's selection is retrieved from the database, the PLM procedure commences. As per the product specifications, the BOM has been subject to a recall, prompting the initiation of internal supply chain operations. In the event of stock unavailability, external measures would be pursued as necessary.

Experimental Study

This section provides an illustrative example to elucidate the functioning of the developed model. The end user within the system has developed a product and subsequently submitted it to a service provider. The meal is prepared by service providers following the level of demand. Once the data has been inputted into the system with the assistance of kitchen and service employees, the resulting product, namely the meal, is prepared for serving. Table 1 showcases a notable instance of a product that has been meticulously crafted and tailored by consumers.

Table 1: Illustrative Example for Personalized Product

Product Name	Price	Product Type	Serving Time	Serving Type	Preparation Time
Trad	80	Main course	5	hot	10

Table 1 presents data pertaining to the information-related product referred to as "Trad". The designated product is characterized by several key data points in the provided table, including price, product type, serving time, serving type, preparation time, and cost. The present database incorporates a cross-query that connects the Product and Customer Preferences databases. The product in question is a customized meal.

The model in question comprises also tables including BOM and Supplier information. The outcomes of the cross-query conducted between the BOM and Supplier tables have been consolidated and presented in Table 2.

Table 2: The Cross-Query Between BOM and Supplier Related the Product "Trad"

Material Name	Quantity	Measure ment Unit	Price	Supplier Name	Lead Time of each Material-days
Meat	151	gr	24.5	BsPnr	2
Sauce	11	gr	0.3	Tt	2
Chili pepper	4	gr	0.1	Yalcin	3
Butter	26	gr	3.25	Sutas	1
Lavash	121	gr	2.4	Own bakery	1
Yogurt	100	gr	2.2	Sutas1	1
Parsley	10	gr	1	Wholesaler	1
Onion	10	gr	1	Whl1	1
Tomato	10	gr	1	Wh2	1
Fresh pepper	8	gr	0.5	Whl3	0
Brass	50	gr	2	Demirci	0

Table 2 presents a comprehensive overview of the BOMs and accompanying supplier information, effectively consolidating these details inside a single table. The database facilitates the consolidation of all materials and their respective providers into a single table, for the planned product "Trad" allowing for efficient summarization. Managerial controls are crucial in overseeing a certain product's lifecycle, encompassing several stages such as design (based on customer preferences) and the procurement of materials listed in the BOM.

Another significant inquiry pertains to the relationship between the product and the BOM. A comprehensive database must be established to link each resource (material) with its corresponding product.

Table 3: The Cross-Query for BOM and Product Tables

Product. Product Name	Product Type	BOM.Material Name	Quantity	BOM.Price	Lead Time of each Material-days
Trad	Main course	Meat	151	24.5	2
Trad	Main course	Sauce	11	0.3	2
Trad	Main course	Chili pepper	4	0.1	3
Trad	Main course	Butter	26	3.25	1
Trad	Main course	Lavash	121	2.4	1
Trad	Main course	Yogurt	100	2.2	1
Trad	Main course	Parsley	10	1	1
Trad	Main course	Onion	10	1	1
Trad	Main course	Tomato	10	1	1
Trad	Main course	Fresh pepper	8	0.5	0
Trad	Main course	Brass	50	2	0

Table 3 represents the cross-query conducted between the BOM and the Product Table. Table 3 presents a comprehensive overview of product categories and pertinent details derived from the BOM table. This includes the name, amount, price, and lead time of each material associated with the respective product kinds.

Given that the research is centered around a customized product, it is imperative to establish a reciprocal relationship between the product itself and the preferences of the customers.

Table 4: The Cross-Query Between Product and Customer Preferences Tables

Product.Product Name	Customer Preferences.Serving Type	Customers Name	Product.Price	Serving Time (Min.)	Preparation Time	Cost
Trad	hot	MrA	75.00	15	10	40
Vegan1	cold	MrsB	45.00	10	10	31
Vegan2	cold	MrX	48.00	8	10	32
FF1	hot	MrK	70.00	12	10	46
LowS	cold	MsC	65.00	17	10	45
BAC	hot	MrA	110.00	20	10	65

Table 4 presents a summary of the inquiry conducted on the relationship between Product and Customer Preferences. The table presented has a total of six distinct product categories. For every individual product, essential details include the serving kind (either hot or cold), customer information (namely, the client's name), and the corresponding product price, the visualization of serving time (in minutes), preparation time (in minutes), and cost data is presented in Table 4.

Tables 1, 2, 3, and 4 present the relevant data on managerial control and monitoring. In the produced database, it is possible to build further queries to achieve the desired objectives. The aforementioned four tables serve as illustrative examples to demonstrate the many functionalities of a database.

The designated model and the database provide the monitoring of comprehensive product information throughout the whole lifecycle, encompassing aspects such as design and material supply. This includes the identification of necessary materials, estimation of time and labor required for preparation and delivery, documentation of supplier details, and assessment of lead times associated with each material.

In addition, the PLM cycle encompasses one more step EoL phase. When there is a drop in demand, the economic and financial circumstances may compel the restaurant to cease serving the product, resulting in its EoL.

Results and Discussions

The last pandemic brought to light that the service sector exhibits a greater inclination towards digital technologies than the manufacturing sector. The process of digitalization possesses both positive and negative aspects. Nevertheless, the ability to monitor and manage all processes concurrently is beneficial for organizations. However, this process must be meticulously and thoroughly planned. In contrast, such actions result in escalated expenses and a squandering of valuable time.

In the context of a cyber social environment, the presence of vast amounts of data is an unavoidable occurrence. To mitigate any issues inside the system, it is imperative to construct a meticulously structured database.

At now, there is a growing trend in the manufacturing industry towards the utilization of individualized data and a preference for prosumer design among firms. Emerging economic models, such as the shared economy and crowdsourcing, enable the active participation of prosumers throughout the entire production process, including the initial design phase, through the utilization of internet-based platforms. To ensure transparency within the ecosystem, service providers must develop an end-to-end digitally connected environment. The utilization of PLM serves as a comprehensive approach to achieving this objective. PLM offers a digitally easy solution, encompassing the engagement of prosumers in the system as well as the EoL management of a product.

The majority of service businesses are characterized by a high degree of reliance on human labor. The COVID-19 epidemic and shifts in manufacturing practices have demonstrated that while technology advancements typically originate and are applied in the production sector, there is a current requirement for structural modifications within the service industry.

The scope of digitalization implementation in this study, about a food service provider, can be expanded to incorporate Internet services. In order to optimize efficiency in preparation and supply chain operations, it is recommended that the service provider adopt a practice of accepting orders for new products one day in advance. A web-based user interface can be developed to gather data before the provision of a service.

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Atıf için:

Moğol Sever, M. (2024). Product Lifecycle Management (PLM) Model in a service industry: Service Lifecyle Management (SLM) Model. *Çankırı Karatekin Üniversitesi Sosyal Bilimler Enstitüsü Dergisi*, *15*(2), 523-539. doi: 10.54558/jiss.1191683.

Etik Beyanı:

Bu çalışmanın tüm hazırlanma süreçlerinde etik kurallara uyulduğunu yazarlar beyan eder. Aksi bir durumun tespiti halinde Çankırı Karatekin Üniversitesi Sosyal Bilimler Enstitüsü Dergisi'nin hiçbir sorumluluğu olmayıp, tüm sorumluluk çalışmanın yazara aittir. İlgili çalışmada 15.09.2022 tarih ve 388947 sayılı kararla Anadolu Üniversitesi Sosyal ve Beşeri Bilimler Bilimsel Araştırma ve Yayın Etiği Kurulundan gerekli izin alınmıştır.

Yazar Katkıları: Makale tek yazarlıdır.