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Integrating the role of the Product Manager into the Program Manager, System Engineer, and Project Manager Model for Optimizing Complex Product Development Initiatives.

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Lu has been teaching as an adjunct since 1986. After 40 years of working in the Aerospace and held several leadership roles in Advance Aircraft Programs, Engineering and Program Management, Operations, and Customer Support, Dr. Lu retired and started teaching full time as Clinical Assistant Professor at Argyros School of Business and Economics at Chapman University and recently transitioned to teaching at USC.

He focuses on the strategic implementation of technology and innovations, new product development, systems engineering, project and program management, and engineering management. Recently, and in response to industry demands, he is focusing on developing courses in systems integration for product development, and rapid product develop. Witnessing the challenges of graduates seeking employment. He is also interested and conducting research on transitioning from an Academic mindset to a professional mindset. Dr. Lu is also conducting research in Experiential Learning in the global arena.

He has authored a textbook on Product Development for Technical and Non-technical Managers and Practitioners and followed up with a textbook titled: A Practical Project Management Guide for Technical and Non-Technical Professionals. He then released a third book on the Essentials of Operations Management and Supply Chain Management.

Integrating the Role of the Product Manager into the Program Manager, Systems Engineer, and Project Manager Model for Optimizing Complex Product Development Initiatives.

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Abstract

As the demand for developing higher percentages of successful products with shorter cycle times and lower budgets continues to be the expectation, there seems to be a need to revisit the relationship and structure between Program Management, Project Management, and Systems Engineering. Additionally, the Product Manager has been introduced into the mix leading to an even more complex model.

Traditionally, systems engineering manages the development phases such as system requirements, initial designs, specifications, system architecture, system infrastructure, system integration, test, verification & validation, and customer acceptance. Project management focuses on project scope, time, and budget for product development campaigns. Program management provides oversight and is the conduit between the client, the firm, project, systems, and other stakeholders. In essence, program management would ultimately be responsible for meeting customer needs, manage the development process, and achieve business goals such as financial performance, market position, and competitive advantage. Of late, the Product Manager has been introduced as the focal point and conduit to creating customer value.

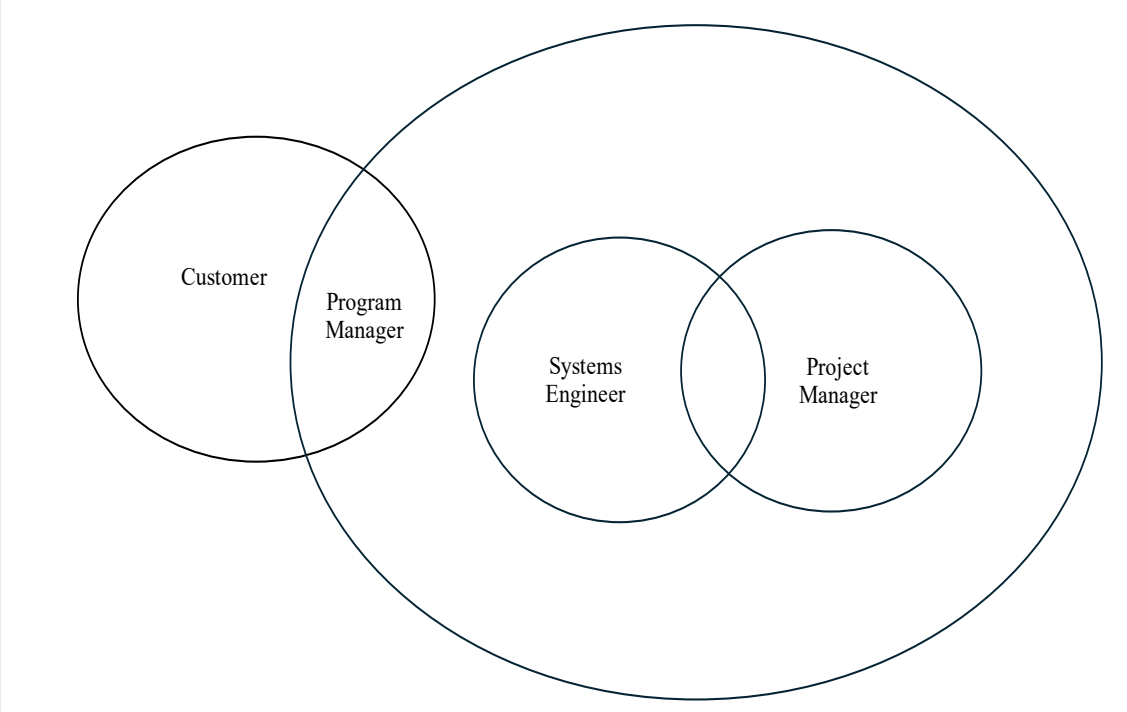
This leads to consideration of a comprehensive fully integrated product development model with emphasis on total integration between the Product Manager (PDM), Program Manager (PGM), Project Manager (PM), and the Systems Engineer (SE). This model may serve as the future roadmap for a multidisciplinary fully integrated product development structure incorporating product management, program management, project management, and systems engineering into a singular entity as opposed to separate and distinct entities.

This paper is a work in progress of such a model for the development of a multidisciplinary, fully integrated structure, describing the architecture, infrastructure, and the interconnectivity between the various sub-systems highlighting the significance and criticality of systems and sub-systems level integration. This is the first phase of this research project, and it is an assessment from the product manager's perspective only. The follow-on phases will encompass the views and perspectives from the program manager, project manager, systems engineer, management, and the customer. Students, faculty, and practitioners in the field of product management, systems engineering, project management, program management, strategies, business management, supply-chain management, and similar disciplines may benefit from understanding and applying this model.

Introduction

Program Management, Project Management, and Systems Engineering are well recognized tools and techniques in the engineering management discipline. Specifically, systems engineering is typically led by senior systems engineers (SE) and the primary focus is on systems level requirements and integration of various sub-system technical activities. Projects are typically led by project managers (PM) and the focus is on completing the project within the triple constraints of scope, time, and cost. Program management is typically led by the program managers (PGM) and focuses on strategic initiatives such as alignment of multiple projects, finance, resource allocation, coordination of cross function activities, and to collaborate with other business units. The PGM manages in a collaborative fashion incorporating program, project, and systems engineering into an integrated systems approach. This approach has been applied in many industries for complex efforts such as New Product Development (NPD) in the aerospace, automotive, healthcare, and information systems. Figure 1 is an illustration of a typical integrated product development model. In this model, SE and PM are coordinating and collaborating on the technical and project level tasks and activities while PGM provides program level support. Program management is also the primary Point of Contact (POC) to the customer.

Figure 1. Illustration of an Integrated Product Development Model with Program Manager, Systems Engineer, and Project Manager



Although this is a robust and proven model, the rate of success is relatively low for implementation of NPD to the market [1], and [15]. Further, of the products introduced to the market many of them prematurely terminate due to lack of sales indicative of misalignment between the customer desires and what is being developed [11].

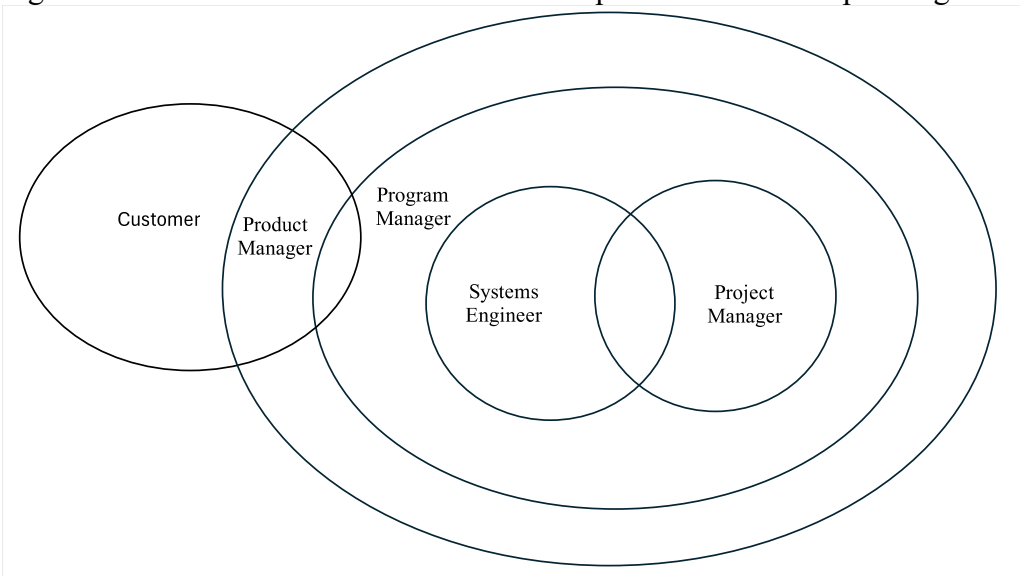
Lately, a new entrant into the product development scene is the Product Manager (PDM). The primary role of the PDN is to focus on the customer and lifecycle management. Immediate advantage seems to be an added focus on the customer and creating customer value. Conversely one of the drawbacks may be the introduction of this new role increases complexity, ambiguity, and duplication of tasks and responsibilities. This new arrangement brings up the question; "How can the PDM fit in and integrate into the Program Management, Systems Engineering, and Project Management model?" Furthermore, what are the upsides and downsides of such an integration. There is a need to develop a comprehensive product development model with the product manager in the mix.

Integrating the PDM into this model will likely experience growing pains and learning curves but should result in a higher probability of successful NPD initiatives. Some of the potential areas of conflicts to consider are:

a. The role of the PDM.
b. Changes in the roles of the PGM, SE, and PM.
c. Change and level of complexity.
d. Advantages, disadvantages, and challenges for the product development team.
e. Advantages, disadvantages, and challenges for the firm.
f. Advantages, disadvantages, and challenges for the customer.
g. Value creation for the customer, the firm, and the team.

Figure 2 is an illustration of a proposed product development model with the introduction of the PDM. In this proposed model, the collaboration and coordination between systems engineering and project management is expected to remain the same. It is envisioned the relationships between the development team and the customer, and interactions between the development team members will change. In this proposed model, program management and product management may be jointly accountable to the customer as well as responsible for the performance of the product development team.

Figure 2. Illustration of the Production Development Model Incorporating the Product Manager



This paper is phase one of a comprehensive research project. Although the findings will only be from the PDM's perspective, it should provide an initial assessment of the value PDMs create in NPD efforts. Additionally, it will serve as the springboard into developing the next phases of this research that will incorporate inputs from PGMs, PMs, SEs, management, and customers.

Literature Review

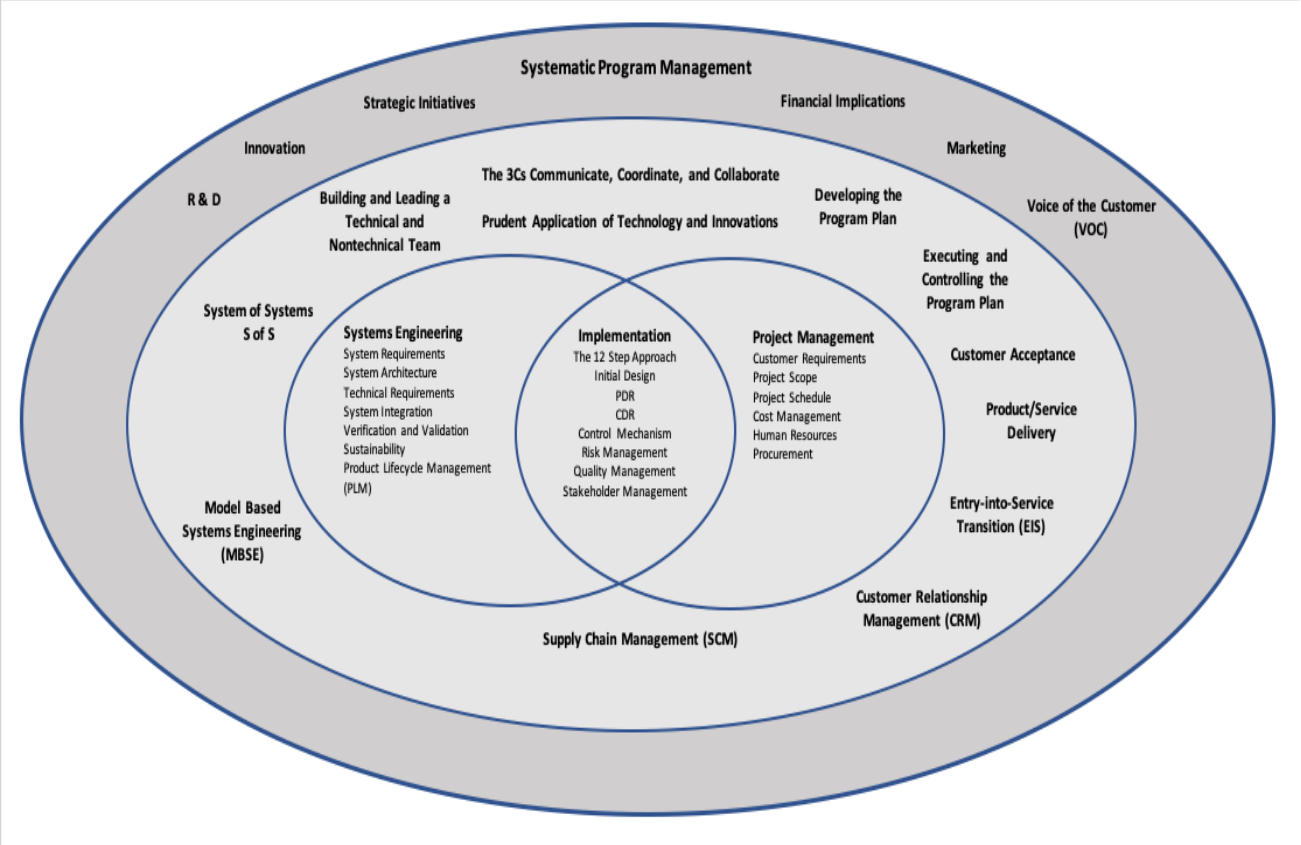
Integrating Program Management, Systems Engineering, and Project Management has long been recognized as a viable approach for NPD [1], [4], [11], and [16]. The International Council on Systems Engineering (INCOSE) have supported and promoted this integrated model for developing complex NDP initiatives. Figure 3 is a typical illustration of a NPD model with Program Management, Systems Engineering, and Project Management integrated systematically. In this model, systems engineering focuses on activities such as systems requirements, architecture, integration, verification and validation (V&V), and product lifecycle while Project Management focuses on customer requirements, project scope, schedule, and budget. These two disciplines' efforts integrate into the implementation of the product development effort. Program Management then serves an oversight function focusing on strategic initiatives and program support.

Although these and similar models are widely adopted across industries such as aerospace, automotive, petroleum, and others, success rates of NPD are relatively low. Some of the root causes attributing to less than desired results are communication, coordination, collaboration, and connecting up and down the entire supply chain.

Figure 3 is an illustration of a typical Program Management, Systems Engineering, and Project Management model. The outer layer of this model is program management with emphasis on strategic initiatives such as Voice of the Customer (VOC), alignment of resources, and financials. The middle layer is tactical with emphasis on planning and organizing the NPD effort, including prudent implementation of technologies and innovations, communication, coordination, collaboration (3Cs), systems engineering approach, supply chain management, customer relationship management, and leading technical and non-technical team members. At the heart of this model is the inner workings and interactions between systems engineering and project management as the nucleus of implementation.

As this is a complex model, opportunities of misalignment, miscommunication, and other risks can easily occur. With the introduction of new entities, processes, and initiatives such as product management may increase the complexity of the system and may impact the stability, flow, and performance of the system.

Figure 3. Typical Integrated Product Develop Model with Program Manager, Systems Engineer, and Project Manager [5]



In 1980, McDaniel and Gray [7] posit the objective of product management is to focus managerial attention on specific products or brands which could not be adequately managed by one person. Furthermore, the roles and responsibilities of the PDM included activities such as strategies of improving and marketing the assigned product, financials, production planning, and monitoring and controlling the execution of the production plan. In essence, from the inception of this role, the PDM was responsible for wide and diverse roles that are intertwined with other disciplines and business units. As such, there has been confusion and controversy relative to the primary tasks, responsibilities, and authorities of the PDM.

McDaniel and Gray offered several questions for firms to consider relating to the integration of the PDM. They are:

a) How much authority
b) Immediate supervisor
c) Degree of dependencies to other business units
d) Organization structure and arrangements
e) Communication protocol
f) Work experience and background

The roles and responsibilities were broken down to the following:

a) Advertising Budgeting
b) Sales Promotion Budgeting
c) Resource Allocation
d) Packing
e) Line Extension
f) Research and Development
g) Pricing
h) Long-range Product Planning
i) Maintaining Profit Goals
j) Distribution Decisions
k) Maintaining Sales Volume

Additionally, collaboration with Operations, Human Resource, Finance, R&D, Sales, and other disciplines are also in contention. The roles and responsibilities of the PDM evolved from its earlier days into more complex and sophisticated models. For instance, Ebert and Brinkkemper [2] proposed product management is the management of products including solutions and services over its lifecycle with the objective of generating the biggest possible value to the business. Figure 4 described Ebert and Brinkkemper's product lifecycle model. This is an end-to-end value driven model. Value creation is further illustrated in their value creation model illustrated in Figure 5. Value creation would start with understanding the need, communicating the value, developing and delivering the value, and sustaining and improving value.

Figure 4. Ebert and Brinkkemper Product Development Model

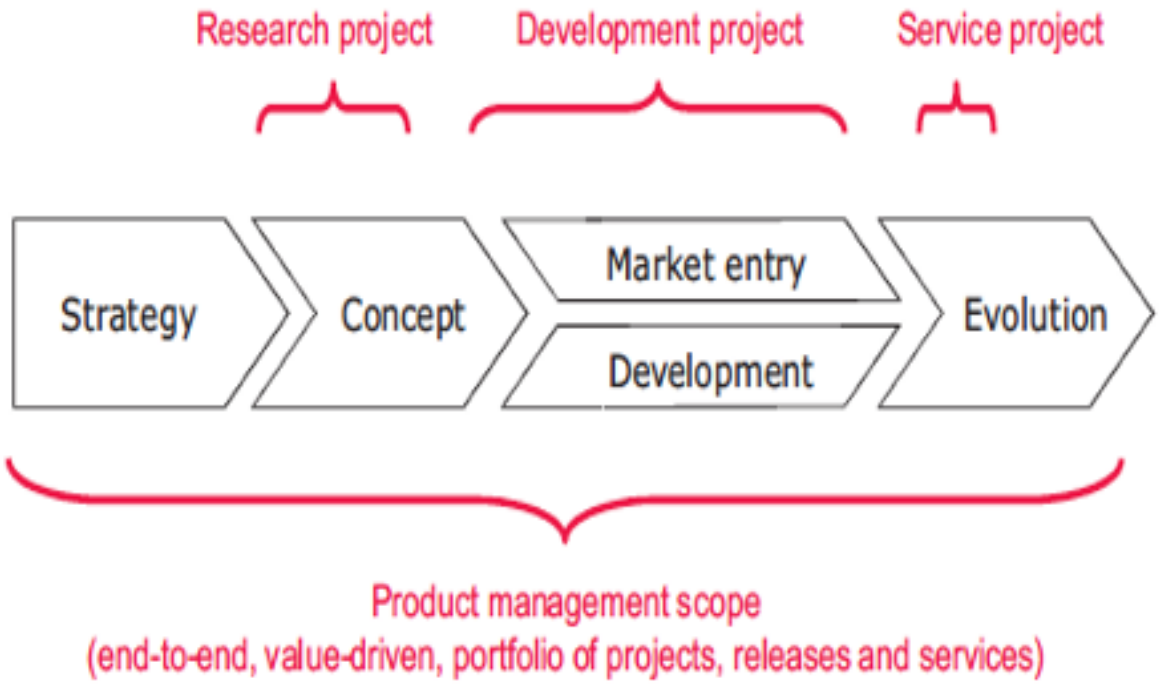
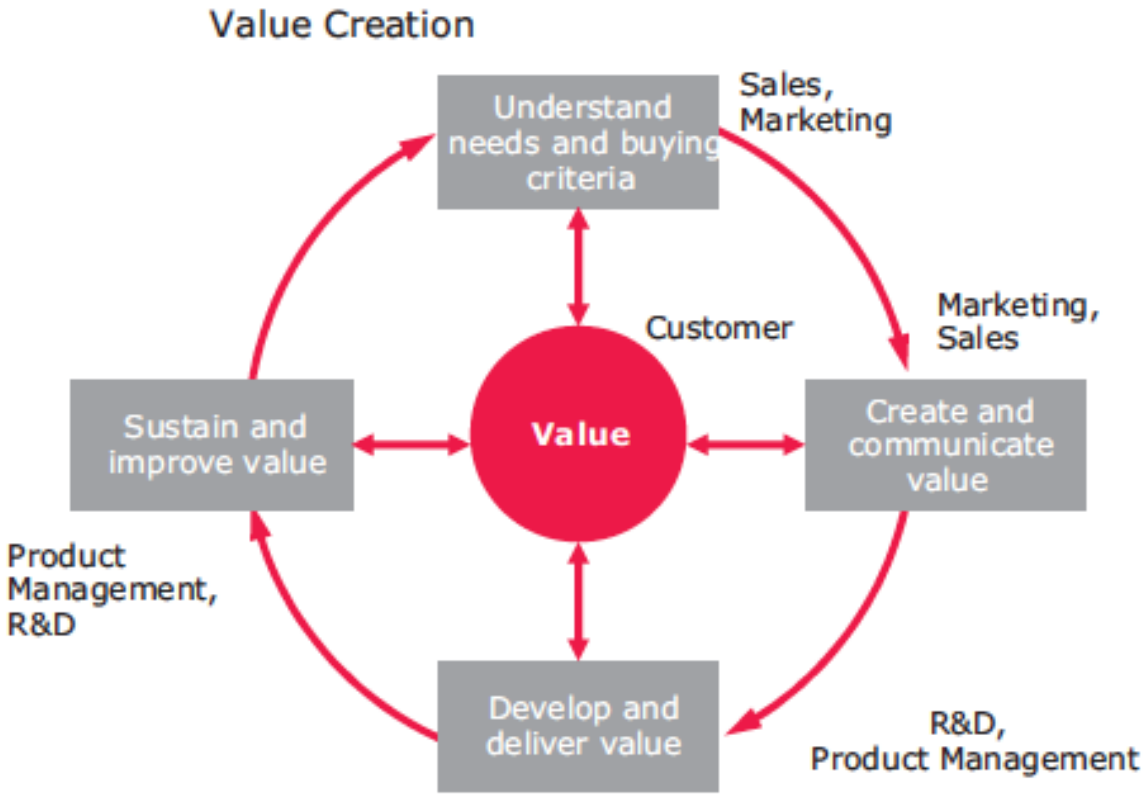


Figure 5. Ebert and Brinkkemper Value Creation Model



Ebert and Brinkkemper also described ten areas of interest for the PDM. They are:

1. What position has product management in the enterprise?
2. What are successful role models?
3. How is the PDM measured?
4. What are the environmental success factors for a PDM?
5. What are the best practices of a PDM?
6. What are the challenges and risks?
7. How PDMs are selected and what are the typical career paths?
8. How do companies train PDMs and grow their skills and competences?
9. Which external standards related to product management are used?
10. Are external certifications used for product management?

These researchers then described challenges the PDM needs to address. They are:

1. Dysfunctional organization with unclear responsibilities and silo work which results in continuously changing focus and schedules.
2. No standardized processes across the company with a slow and cumbersome decision-making process and many individual ad-hoc agreements.

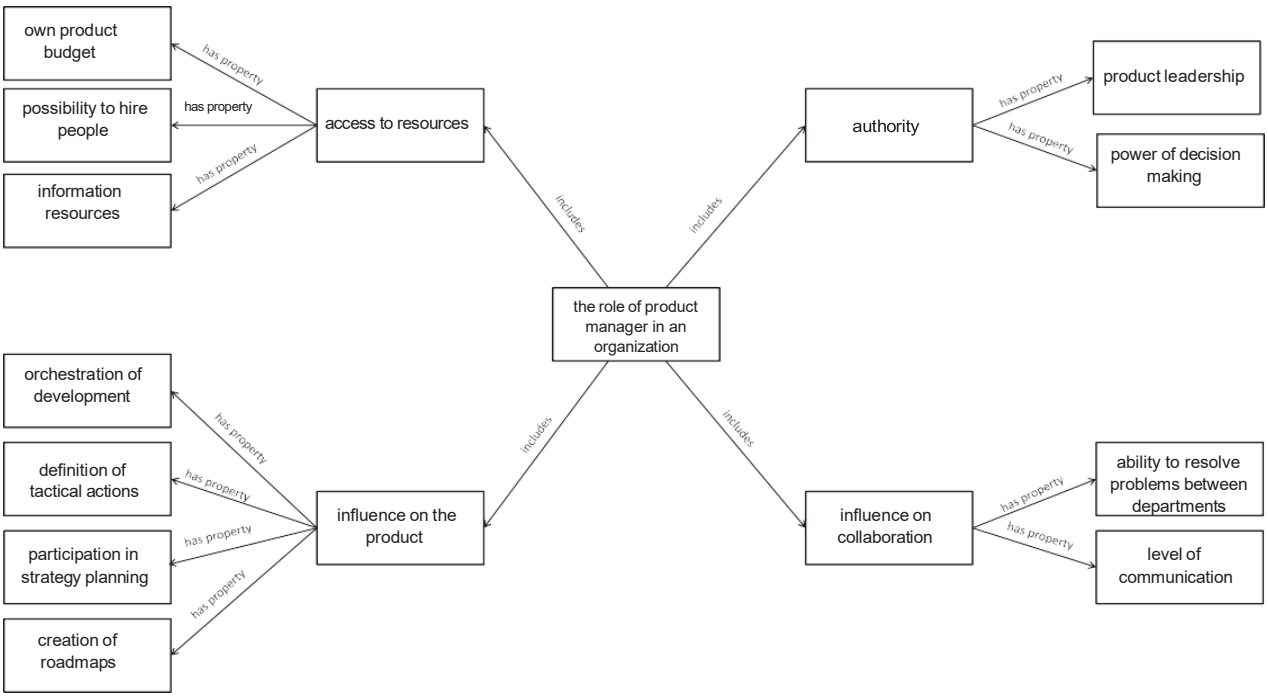
3. Insufficient requirements which are often just collections of what had been heard at customer visits and other such events but not mapped to value creation and business cases.
4. Lack of strategy and unclear strategy and roadmaps with unclear dependencies and fuzzy technical requirements and impacts.

Finally, Ebert and Brinkkemper offers four initiatives on how PDMs can enhance customer value. They are:

1. Core team to have reliable commitments from all functions.
2. Standardized product life cycle to have clear interfaces, milestones and governance.
3. Requirements that transport the customer value to ensure business focus.
4. Portfolio management and roadmapping to facilitate transparency and dependency management.

Maglyas et al. [6], describes the PDM as the expert and a "mini-CEO" claiming the PDM can influence the product by having the right level of authority, access to resources, and be able to influence collaboration. Figure 6 is an illustration of this four-prong model of the role of the product manager.

Figure 6. Maglyas, Nikula, and Smolander Model of the Role of the Product Manager



Rauniar et al. [10] posits PDMs in senior roles have substantial formal and informal influence to assign people, allocate resources, and direct the development team efforts. These capabilities allow PDMs at the senior level to influence strategic alignment, shared project mission, and clarity of project targets. Ultimately, a senior level PDM can have positive impacts on the product development team.

In their 2023 report, Rauniar et al. suggests the role of the PDM is changing with focus on the following four areas. They are:

1. Customer centric solutions
2. Manage the growing complexity of hardware products
3. Adopt agile product development processes
4. Rapid pace of technology change

This assessment is a significant shift on the roles and responsibilities of the PDM since the early days of this position. To be successful, the PDM will need to become a visionary customer-centric leader, ready and able to assess what consumers are saying and to pivot products accordingly. Some of the attributes of this modern-day customer-centric leader would be:

1. Develop a knack for distinguishing desire from need, using basic psychology to help address underlying consumer pain points.
2. Ensure hardware products are designed with an eye toward user experience (UX).
3. Provide real product leadership, showing initiative with regard to which products to build and which features to emphasize.
4. Be responsible for all stages of the product lifecycle, continuing to iterate and support the product even once it's launched.
5. Exhibit excellent communication skills with all company stakeholders, keeping everyone aligned toward the same goals and united around a shared source of truth.
6. Promote clear communication between teams, ensuring a cross-functional product development approach.

It appears modern day PDMs are tasked to do much more than their predecessors. The focus is to ensure products are designed to align with company goals as well as enhancing customer satisfaction.

Springer et al. [12] recommends four factors with positive impacts on product management. They are:

1. Business objectives and accountability.
2. Mastering requirements.
3. Managing risk and uncertainty.
4. Leadership and teamwork.

Figure 7 is an illustration of these four factors with further descriptions of each of the factors. These four factors are another example of the shifting role of the PDM in modern times. Additionally, focusing on four factors would seem to mean a less complex approach to managing product management.

Figure 7. Springer, Miler, and Wrobel Four Product Management Factors

ID	Guidelines towards successful product management	Key takeaways
1	Business objectives and accountability	Product managers must set objectives and work to achieve them. Objectives must be measurable and connected with business needs / strategic goals. Organise a multidisciplinary product team led by a product manager (with product management, sales, marketing, and engineering competencies) so they plan, agree on the strategy and commit as a team.
2	Mastering requirements	Make sure different perspectives are considered while reviewing the requirement (description, impact, priority). Manage requirements and business objectives (plan, prioritise, agree, monitor) to assure focus Analyse the impact of each requirement to check if they support the business case. Document requirements in a structured and disciplined way. Describe both technical and business perspectives. Create Product Roadmaps. Committed roadmaps and requirements must be accessible online together with other relevant product and project information.
3	Managing risks and uncertainty	Manage risks on the level of the product line and roadmap. Use available techniques to deal with requirements uncertainty and master project risks. Prioritise requirements and plan incremental stabilization, measured by the earned value achieved.
4	Leadership and teamwork	Execute strategy consistently. Build an empowered, multifunctional core team fully accountable for the success of the product, having the mandate to "own" the project. Lead team and take short-term and long-term responsibility.

Melagati et al. [9] also offer a commentary on the modern-day PDM for software (SW) development. These researchers suggest the PDM's role as a generalist. Further, SW product managers serve in a multidisciplinary mode encompassing SW, design user experience, and business aspects. Figure 8 is an illustration of their model of a SW product manager. In this model, the PDM has communication, leadership, management, business, SW development, and design responsibilities based on multidisciplinary dependencies that leads to consequences and challenges (going counterclockwise in this model). Of interest are the questions to determine an individual's ability to serve as a PDM, the particulars of the company, and the role of the PDM.

The questions relating to an individual's ability to serve as a PDM are:

1. Do you have an academic degree? In which area?
2. What have you worked on before joining this company? What were your roles? For how long?
3. Have you worked as a PDM in other companies?
4. Did you have experience with business/technology/UX or UI design (ask about the topics not mentioned before)?
5. Could you mention at least three characteristics from you that you believe are important for your role at the company?

Questions about the company are:

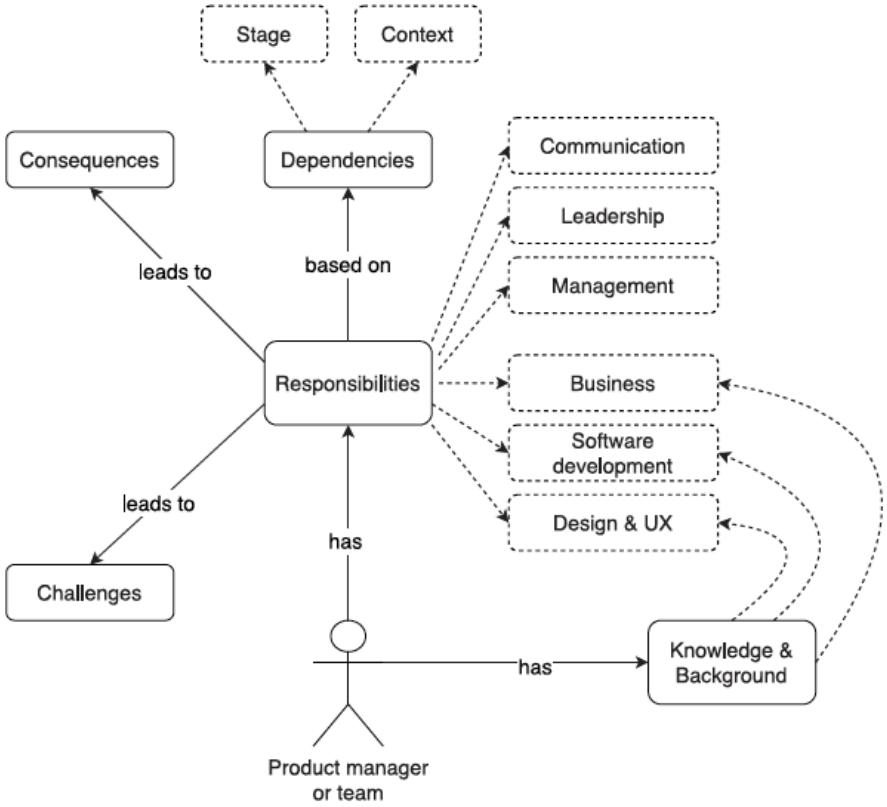
1. What is the product your company develops about?
2. Who are the (potential) customers and users?
3. For how long does the company exist?

4. What is the current stage of the company? Only an idea/ developing an initial version/ few customers or users/ mature stage?
5. What is the size of the company? And the team? What is the composition of the team(s)?

Questions about the role of the PDM are:

1. What are your duties and responsibilities as PDM? (Business, technical, and design)
2. What are the most important duties and responsibilities?
3. What is your daily routine?
4. Do you have weekly or monthly duties that are not included in your daily routine?
5. Does the team follow a defined development process? How was this process defined?
6. Do you have management duties?
7. What are the tools you use?
8. What are the challenges you face?
9. Have you worked in other companies as a PDM?
10. If yes, what are the differences and similarities to your current role?
11. What were the other companies about? Stage, product, etc.
12. What are the differences between your role and others at your current company or at your previous jobs, such as project manager, technical leader, designer, etc?
13. Concluding questions and feedback: Is there any other information you would like to add about your job?
14. Comments and feedback?

Figure 8. Melagati et al. Model of the Roles and Responsibilities of the Software PDM



In Summary, integrated Program Management, Systems Engineering, and Project Management model are widely recognized and utilized across industries. Although a logical and well received model, the success rate from this model is relatively low. The PDM role since its inception has evolved with expanded roles and responsibilities. Of interest would be to understand the pros and cons of integrating the PDM into the integrated Program Management, Systems Engineering, and Project Management model.

Methods

A Five Steps case study approach will be exercised to facilitate further understanding of the role of the product manager and how this role is evolving and integrating into the Program Management, Systems Engineering, and Project Management model [7], [14], and [16]. Specifically, modify Melegati et al.'s [9] battery of questions to facilitate data collection, conduct qualitative analysis, and draw conclusions. The Five Steps are:

1: Data Collection
2: Data Management
3: Data Analysis
4: Data Display
5: Drawing Conclusion

Table 1 describes this process with objectives for each of the steps along with the tools and instruments for data collection. A pilot study was conducted as a means of verification and validation. The research methodology will be revised from the findings of the pilot study. A full comprehensive research exercise will then be implemented in the next phase of this research project. Table 2 is a list of the initial semi-structured questions.

Table 1. The Five Steps Case Study Method

Steps	Objective	Tools/Instruments
Data Collection	Collect and organize data for storage, retrieval, and processing	Introductory letter, Pre-visit Guide, Semi-structured Interview Questions, Interview Checklist, and Digital Recordings and Transcript of the interview
Data Management	Organize data such that it can be reduced for analysis	Contact Summary Sheet, Document Summary Sheet, and Data Management Checklist
Data Analysis	Analyze data using recognized methodologies; formulate explanations and generalizations based on the analysis	Coding, memoing, case analysis meetings, vignettes, and pre-structured case outlines.
Data Display	Present the findings in meaningful ways	Tables, charts, graphs, vignettes, and narratives.
Drawing Conclusions	Lead the reader to conclusions by drawing from and making generalizations from the case.	Tactics for generating, testing, and confirming meanings

Table 2. List of Semi-Structured Questions

	Questions
1	What is your background and work experience?
2	What are your role and responsibilities (R&R) as the Product Manager?
3	Are you involved in the design of new products?
4	Are you involved in the user experience of new product introductions?
5	Do you interface with the Program Manager, Project Manager, and Systems Engineers?
6	If so, how is your role integrated with the program manager, project manager, and the systems engineer?
7	In your opinion, what do you think is the R&R of the Program Manager, the Project Manager, and the Systems Engineer?
8	Do you think your role increases or decreases complexity in the product development process?
9	In your opinion, what do you think are advantages and disadvantages of incorporating the role of the product manager into the product development process from the team, firm, and customer's perspective?
10	Can you describe the before and after of incorporating the role of the product manager?
11	What do you think are the challenges for the product manager in relations to the product development process?
12	In your opinion, how is the role of the product manager creating value for the Product Development team, the firm, and the customer?
13	Who is the primary interface to the customer before and after incorporating the product manager?
14	Who is the primary interface to management before and after incorporating the product manager?

Data Management

Data collected will be formatted, structured, and stored to enable retrieval for processing and analysis. The format will enable the data to be coded into categories, so it can be sorted and organized into a database. Data will be identified, cross referenced, and linked to its source. Memos and notes collected during the interview will be documented and consolidated. A checklist will be used to track the data collection to ensure data integrity and traceability. Table 3 is an example of the checklist.

Table 3. Data Management Checklist

Informant	Interview	Memos	Observations
X	X Int (date)	X Memo (date)	X Observe (date)
Y	Y Int (date)	Y Memo (date)	Y Observe (date)

Data Analysis

The analysis will consist of reviews of the information collected from the semi-structured interviews. A summary sheet outlining the responses of each question from each informant will

be generated. A case analysis meeting will be conducted with the informants to verify and validate the documented results. Vignettes will then be created from each of the interviews. Finally, common and emerging themes from the coding and memoing exercise will be produced. Table 4 is an illustration of a pre-structured coding scheme tracker. This template will be the primary tool for coding with specific associated word strings.

Table 4. Pre-structured Coding Scheme.

	Code	Content
Role of Product Manager		
Role of Program Manager		
Role of Systems Engineer		
Role of Project Manager		
Integration of Product Manager		
Complexity		
Advantages for Team		
Disadvantages for Team		
Challenges for Team		
Advantages for Firm		
Disadvantages for Firm		
Challenges for Firm		
Advantages for Customer		
Disadvantages for Customer		
Challenges for Customer		

Displays

Primary displays of the results from analysis will be in tabulated formats. Table 5 describes the particulars of the product development team interactions from the Product Manager's perspective. Table 6 is a summation of the customer and the Firm's advantages, disadvantages, and challenges from the product manager's perspective. Table 7 is an assessment of the before and after of the introduction of the product manager.

Table 5. Product Development Team Interactions from the Product Manager's Perspective

	Product Manager	Program Manager	Systems Engineer	Project Manager
Roles and Responsibilities				
Interface				
Complexity				
Advantages				
Disadvantages				
Challenges				

Table 6. Advantages, Disadvantages, and Challenges from the Customer and Firm Perspective

	Customer	Firm
Advantages		
Disadvantages		
Challenges		

Table 7. The Before and After of the Introduction of the Product Manager

	Before Intro of PDM	After Intro of PDM
Rate of Success		
Return on Investment		
Customer Loyalty		
Repeat Business		
Market Share		

Drawing Conclusions

The formulation of results will draw from tested and confirmed common and emerging themes. The results will have theoretical implications as well as offer insights for practitioners in the field. As the inputs for this study are only from product managers, the results are limited and may be biased from the product manager's perspective. However, the results should shed light into the value of the product manager in product development.

In the next phase, the same research methodology will be applied to Program Managers, Systems Engineers, and Project Managers to gain insights from the various members of the product development team. Further, inputs from customers and management will also be solicited using the same methods. Table 8 is a summation of codes before and after the introduction of the product manager.

Table 8. Summary of Various Aspects of Interactions Before and After the Introducing the PDM

Codes	Before Product Manager	After Product Manager
Role of Product Manager		
Role of Program Manager		
Role of Systems Engineer		
Role of Project Manager		
Integration of Product Manager		
Complexity		
Advantages for Team		
Disadvantages for Team		
Challenges for Team		
Advantages for Firm		
Disadvantages for Firm		
Challenges for Firm		
Advantages for Customer		
Disadvantages for Customer		
Challenges for Customer		

Further research into the impacts of the introduction of the PDM into other business disciplines such as Engineering, Customer Support, Sales, Marketing, Operations, Supply Chain, Human Resources, Quality, and Finance may also be beneficial. This may become phase three of this research project.

The Pilot Study

A pilot study was conducted consisting of an interview with one PDM following the Five Step method. Data was collected via semi-structured interview and notes. The interview was recorded and transcribed for analysis using the Contact Summary Sheet and the Data Management Checklist.

Analysis was conducted by searching for specific word and/or word strings for common themes into codes. Memoing of significant comments were collected and consolidated to support the common themes. There was a case analysis meeting with the informant to verify and validate findings. Finally, a vignette was created of the informant's story and produced a case outline. The findings from the pilot study will provide an initial assessment and will also assist with refining the methods model.

Data Collection

An introductory letter was sent to the pilot informant via email and followed by a pre-interview guide. The semi-structured questions and a checklist was used to facilitate the interview. The interview was conducted remotely. The informant's responses and comments were captured via video recording with accompanying transcripts.

Data Management

The contact summary sheet and the data management checklist were used as a guide to facilitate the management of the data collected from the informant. The recording and transcript were reviewed to capture information obtained and information not obtained. Additionally, other salient, interesting, illuminating, and important topics were also captured. Comments relative to the main themes were captured as codes with associated content and served as the basis for the analysis process. Additionally, it also assisted with responses not captured from the semi-structured questions, and also with potential new questions to be included for future data collection. Table 9 is a short list of codes and contents captured.

Table 9. Start List of Codes, with Linked Quotations

	Code	Content
Role of Product Manager (PDM)	DP1	Voice of the Customer within the organization
	DP6	Break up that big picture into small units of work that could actually be completed
	DP7	Define the acceptance criteria
	DP16	More from an oversight perspective

Role of Program Manager (PGM)	DP22	Program managers, that tends to be for some kind of initiative that's bigger than one product.
Role of Systems Engineer (SE)	DP30	And then systems engineer, again, we don't really have that role. So, it's hard for me to speak to it.
	DP31	We do have a role called functional architect. And that role tries to understand how all of our product's kind of fit together and how we leverage frameworks that we've built internally most effectively or when they get enhanced.
Role of Project Manager (PM)	DP24	Deployment
	DP25	Coordinate communication with customer
	DP26	Constant communication
	DP29	Defined start a defined end and a defined list of work to complete, and that person's job is to understand that work, understand the dependencies, create the timeline and get it to be done.
Integration of Product Manager (IPM)	DP19	Design flow
	DP20	Language of intertwined
	DP21	Interchangeable, I mean from a design perspective, there's a functional design
	DP22	I'll kind of share my context with each of them
	DP27	SE is not a role we integrate with
Complexity (COM)	DP4	Changes all the time
	DP28	We kinda have to wear that hat sometimes. Like if we need to work across teams, then that's just something we end up doing.
	DP32	A lot of those designs faster and then work more efficiently with the development team to create a product that's ultimately acceptable by the customer. So is it more complex?
Advantages for Team (AT)	DP2	Understand the problem the customer trying to solve and then work internally on creating and delivering a solution
	DP5	Work in like an Agile development environment
	DP9	Making my team successful
	DP10	Create the clearest scope of work for them to focus on
	DP11	How can I remove obstacles so they can do their work most efficiently
Disadvantages for Team (DT)	DP35	Some engineering folks view product managers as glorified project managers. And that they have too big of a voice and that they don't understand technology enough
Challenges for Team (CT)	DP13	Sounds simple, but for some reason it is really hard.
	DP37	I think product managers like to pretend we're in charge. And then I think the people who lead the

		development team feel like they are actually the ones in charge. And I think that creates some tension at times
Advantages for Firm (AF)	DP8 DP14 DP17 DP38	Customer to validate those designs in our space A lot of stakeholder alignment Crystalizing into a goal for the organization I think ultimately if the product manager's job to maximize ROI
Disadvantages for Firm (DF)		
Challenges for Firm (CF)	DP23 DP36	Very strategic for the company to be successful I think that's an interesting balance of who's in charge.
Advantages for Customer (AC)	DP3 DP12 DP33	Red tape of whatever I think they're closes to the product and the customer so they're gonna make the best decisions They know everything about it, and they have the power to change it in a way that will benefit you as customer
Disadvantages for Customer (DC)	DF34	I don't really see any disadvantages from a customer perspective
Challenges for Customer (CC)	DP15 DP39	Find creative ways to solve problems in a way that does align with our solutions Because you have a new solution that adds new value.

Data Analysis

Following the analysis method, a review of the codes and memoing was conducted to consolidate the information collected and then collated into the various categories. A case analysis was then conducted with the informant to verify and validate the findings. A vignette was generated reflecting on the particulars shared by the informant. Lastly used the pre-structured case outline to assist with formulating the theme of the findings.

Vignette

The pilot study informant is a PDM who enjoys solving problems with real solutions. For this informant, the PDM should be detail oriented and be able to see the big picture. Additionally, be able and willing to make contributions towards successful implementations.

The informant stated the roles and responsibilities of the PDM varies and the following is a generally recognized list of roles and responsibilities.

1. Be the Voice of the Customer (VOC)) to the organization
2. Be able to understand the problem and the real solution
3. Be able to navigate the company process/organization/bureaucracy/red tape
4. Manage Agile: Scrums and Sprints

5. See the big picture and work towards the future state
6. Work in three work frames (now-deploy-future)
7. Be a Leader
8. Make the team successful
9. Create space for team to be successful
10. Stakeholder alignment
11. Vision setting
12. Turn objectives into results

In terms of product design, the informant has an oversight role. This said, the PDM is completely intertwined in the design starting from the user and flows all the way to the developers. The informant is not involved with the technical designs. In some instances, the PDM is involved in the functional aspects of the product design.

The informant is also actively engaged in user experience of new product introduction. In fact, the informant sees product design and user experience as interchangeable. The PDM's involvement would be less technical but more on the functionality of the design.

From the informant's perspective, program managers are responsible for multiple projects at the strategic level. Project managers focus on deployments with tools such as scrums and sprints. The informant does not interact much with systems engineering. In some instances, the informant is connected with the development project and assumes the role of the project manager. The informant also interacts with program management to ensure smooth operations and collaborates with systems engineering on functional architecture. The informant suggests the PDM serves a marketing role in collaboration with the subject matter experts (SMEs). It is about working together to enhance efficiency

The advantages of incorporating the role of the PDM are enhanced customer interface. The PDM becomes the expert go to change agent that can be trusted. The disadvantage is the PDM can easily become a glorified project manager.

Before the introduction of the PDM, product development was an engineering initiative. After the incorporation of the PDM, the product development process is multidisciplinary. There is a sense of priority for product development as an organization goal to deliver on market fit.

The informant provided the following as challenges from the PDM perspective.

1. Balance of who is in charge
2. Leadership
3. Team dynamics
4. Trust
5. Manage priorities and expectations
6. Impact of changes in the organization structure
7. Awareness

8. Less in transition state to ready state

The PDM creates value by maximizing Returns on Investment (ROI) for the firm and customers. Theres is a constant thinking about value creation from both the firm and the customer perspectives. The PDM creates a value story that links vision to adoption that creates value.

The PDM is the primary customer interface. As such the informant clearly understands the goals of the product from the customer's perspective. The focus is on customer success. Interestingly, the PDM is not the primary interface to the firm's leadership. There is an organizational hierarchy and the PDMs report up to the Vice President of Product. Senior Leadership is typically briefed by the senior management.

Table 10 is a summary of the product development team interaction with the PDM, program manager, systems engineer, and the project manager from the PDM's perspective. From the pilot study, the PDM roles is tactical and customer facing. The PDM interfaces with the customer, program office, and the project manager. The advantage of the PDM is enhanced VOC, and the disadvantage is added complexity. The major challenge is determining who is in charge in a complex management model.

The program manager is strategically focused on multiple projects. The program manager interfaces less with the customer and more with the PDM. The advantage is strategic alignment, and the disadvantage is limited communications. The major challenge is the limited interactions between program leadership and the PDM.

The systems engineer is responsible for systems design and architecture. The systems engineer interfaces less with the customer and more with the PDM. The major advantage is to enable the systems engineers to be technically focused, and the disadvantage is the separation between the functional and technical architecture. The challenge is meaningful collaboration between the technical and non-technical communities.

The project manager is focused on operational activities and deployment focusing on daily activities such as scrums and sprints. The project manager also interfaces less with the customer and more with the PDM coordinating communications with the customer. The advantage is more project focus, and the disadvantage is separation between the customer and project deliverables. The challenge for project managers is communication, coordination, and collaboration.

Table 10. Product Development Team Interactions from the PDM's Perspective from Pilot Study

	Product Manager	Program Manager	Systems Engineer	Project Manager
Roles and Responsibilities	Tactical Customer	Multiple Projects Strategic focus	Technical Architecture	Operational activities - deployment - Scrums and Sprints

Interface	Customer, Program, and Project	Less with customer and more with product manager	Less with customer and more with product manager	Less with customer and more with product manager – coordinate communications with customers
Advantages	Enhanced VOC	Strategic alignment	Technically focused	Project focused
Disadvantages	Adds complexity	Limited communications	Separation between functional architecture and technical solutions	Separation between the customer and the project deliverables
Challenges	Who's in charge?	Limited interactions	Collaboration	Communication, Coordination, and Collaboration

Table 11 is an illustration of the advantages, disadvantages, and challenges of the incorporation of the PDM into the product development process. From the customer's perspective, the advantage is ROI, and the disadvantage is limited access to others in the firm. The challenge is ensuring the VOC is rolled down to others in the firm. From the firm's perspective, the advantage is also enhanced ROI, and the disadvantage is increased complexity. The challenge is "Who's in charge?"

Table 11. Advantages, Disadvantages, and Challenges from the Customer and Firm Perspective from the Pilot Study

	Customer	Firm
Advantages	ROI	ROI
Disadvantages	Limited access to others in the firm	Increased complexity
Challenges	Rolling down the VOC	Who's in charge?

Table 12 is an illustration of the before and after of the introduction of the PDM relative to rate of success, return on investment, customer loyalty, repeat business, and market share. Unfortunately, the pilot study methods were not able to draw specific conclusions. Although there were implied improvements needed before the introduction of the PDM and implied improvements after the introduction of the PDM, this area will need to be revised going into the full implementation phase.

Table 12. The Before and After of the Introduction of the Product Manager from Pilot Study

	Before Intro of PDM	After Intro of PDM
Rate of Success	Implied improvements needed	Implied improved via ROI
Return on Investment	Implied improvements needed	Improved

Customer Loyalty	Implied improvements needed	Implied improved
Repeat Business	Implied improvements needed	Implied improved
Market Share	Implied improvements needed	Implied improved

Drawing Conclusions

The formulation of results draws from tested and confirmed comments and emerging themes. As the inputs for this pilot study are only from one PDM, the results are limited and may be biased from the product manager's perspective. However, the results should shed light into the value the PDM creates in product development. In the next phase, a revised research methodology based on findings from this pilot study will be applied to other PDMs interviews to gain further insights from their perspectives. Table13 is a summation of codes before and after the introduction of the PDM. Note that some of the codes are not applicable in the "Before Product Manager" column.

Table 13. Summary of Various Interactions Before and After the Introduction the PDM

Codes	Before Product Manager	After Product Manager
Role of Product Manager	N/A	Customer POC
Role of Program Manager	Strategic	No Change
Role of Systems Engineer	Customer engagement Functional Architecture and technical solutions	Technical solutions
Role of Project Manager	Task driven	No Change
Integration of Product Manager	N/A	Champions the VOC
Complexity	Lines of communication between customer and development team	Streamlined lines of communication but introduced more complexity
Advantages for Team	NA	Point of Contact to the customer
Disadvantages for Team	NA	Increase complexity
Challenges for Team	Customer focus	Who's in charge
Advantages for Firm	NA	Higher ROI
Disadvantages for Firm	NA	Added complexity
Challenges for Firm	NA	Alignment of resources
Advantages for Customer		Ease of doing business with supplier
Disadvantages for Customer	Multiple supplier contacts	Access to others in the firm
Challenges for Customer	Navigating the supplier's process and system	Opportunities to hear other voices

From this pilot study, findings relative to the advantages, disadvantages, and challenges of the introduction of the PDM for the customer, the firm, and the product development team seems to be supported. Further, it appears the advantages outweighs the disadvantages. In summary, it appears the introduction of the PDM enhances customer relationships and streamlines the 3Cs. The PDM is the VOC and acts as the champion for the customer in the firm. Additionally, the

PDM is in a leadership role to the product development team and is focused on providing the necessary resources for the team to be successful. The PDM also creates value for the firm's management acting as the bridge between the customer and the firm.

It appears the strategic relationships and interactions between the PDM and program management is well understood. This is also the case for the tactical and operational interactions with project management. The relationships and interactions between the PDM and systems engineering is not clearly defined. This critical relationship will be investigated further in the next phase of this research.

In general, the challenges relate to increased complexity as a result of incorporating the PDM into the process. The PDM adds a layer of management into the organization. As such, issues such as reporting structure, duplication of work, and lines of communication needs to be addressed. Further, team dynamics and team collaborations needs to be carefully managed.

Table 14 is the revised semi-structured questionnaire. Question 6 is deleted and incorporated into question 5. Additional details relative to Rate of Success, Return on Investment, Customer Loyalty, Repeat Business, and Market Share are added in question 9 to support the before and after results of incorporating the PDM. In the next phase, this revised set of semi-structured questions will be used to facilitate interviews with informants.

Table 14 Revised Semi-Structure Questionnaire Based on Pilot Study Findings

	Questions
1	What is your background and work experience?
2	What are your role and responsibilities (R&R) as the Product Manager?
3	Are you involved in the design of new products?
4	Are you involved in the user experience of new product introductions?
5	Do you interface/integrate with the Program Manager, Project Manager, and Systems Engineers?
6	~~If so, how is your role integrated with the program manager, project manager, and the systems engineer?~~
7	In your opinion, what do you think is the R&R of the Program Manager, the Project Manager, and the Systems Engineer?
8	Do you think your role increases or decreases complexity in the product development process?
9	In your opinion, what do you think are advantages and disadvantages of incorporating the role of the product manager into the product development process from the team, firm, and customer's perspective?
10	Can you describe the before and after of incorporating the role of the product manager (added: in terms of rate of success, ROI, customer loyalty, repeat customer, and market share)?
11	What do you think are the challenges for the product manager in relations to the product development process?

12	In your opinion, how is the role of the product manager creating value for the PD team, the firm, and the customer?
13	Who is the primary interface to the customer before and after incorporating the product manager?
14	Who is the primary interface to management before and after incorporating the product manager?

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