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Maturity Model for Customer-Centric Approach in Enterprise: The Case of E-commerce and Online Retail Industry

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by

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A dissertation submitted in partial fulfillment of the
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Abstract

The network technologies are changing the dynamics of the interaction between customer and provider. Customers demand closer relationships and higher investment between partners, as well as cooperation between companies to build supporting technologies for their unique needs. [1] Customer-centricity is defined as interaction with the customer through various touchpoints and aggregating these relations to create a position for the customer. Each Customer has a different need and expectation from the provider or seller, and companies need to be flexible enough to fulfill their needs. [2] One of the reasons organizations invest less in customer experience is that they believe they are already customer-centric organizations. [2]

Companies need to deploy structured methods to evaluate their customer-centricity as it is now to achieve this purpose. Also, the techniques should enable them to plan the organization's evolution toward the customer-centric approach strategically. This research focuses on designing a new maturity model to evaluate and plan an organization's customer-centricity. The Hierarchical Decision Model (HDM) is used as the primary methodology to quantify impacting factors and intensity of influence on the ultimate outcome.

To demonstrate the proposed model in the real world, a case study is performed in the E-commerce industry, especially B2C online retailer organizations. This industry is selected because of the high impact of customer-centricity on the success of

businesses. Also, in order to deliver the best experience, e-commerce firms need to stay on top of cutting-edge technologies and related practices.

Dedication

To my wise, kind, and supportive wife,

Shirin Yekekar, Ph.D.,

who made this journey possible.

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The Ph.D. studies is a journey that is impossible to accomplish without the outstanding support and help from many people who lean in and make it possible.

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Chapter One: Introduction

Research Motivation

Customer-centricity is defined as interacting with the customer through various touchpoints and aggregating these relations resulting in building a position for the customer. Each Customer has a different need and expectation from the provider or seller, and companies need to be flexible enough to be able to fulfill their needs. [2] As the most customer-focused organization, Amazon clearly states Customer-centricity in the company's mission statement: "To be Earth's most customer-centric company." This statement shows the commitment, focus, and importance of customer-centricity for this organization's leaders and their belief in this concept. [3]

Besides, the undeniable impact of Artificial Intelligence and the Internet of things on the value proposition and offerings of firms drive many strategic initiatives in organizations to design solutions that integrate products and services. In order to create loyal customers and keep them for the long term, organizations need to build capabilities to be more flexible and agile to provide the novel needs of the customers.

Customer expectations and behaviors have changed dramatically over the past decade. Organizations are expected to meet customers' needs and expectations at every interaction in return for customer loyalty. The ability to deliver such a flexible solution depends on how customer-centricity is embedded within every person in the business. [4]

In the twenty-first century, successful companies follow and build customer-centric capabilities to serve their customers better experiences. [2] The products' quality has reached a certain level of saturation in various product lines, and close competition makes the profit margin smaller and smaller every day. Selling products or services without focusing on customer experience and their real needs shrinks the companies' profit tremendously. [2]Long-term relationships between providers/sellers and customers are a competitive advantage that is not easy to duplicate, understand and implement for competitors. [1]Gartner predicts that by the year 2020, poor customer experience will destroy 30% of digital businesses in organizations.[5]

Any customer value can be defined as a sum of product value and service value. The percentage of service value to total customer value is growing. [6] This creates complexity for the organizations that provide these services and the organizations that develop the products. The two must be aligned to deliver customer value. This co-dependency and integration are critical in emerging technology development. [7][8][9][10]

In this decade, the companies are challenged by competitors' products and their capability to deliver reliable and robust services. The designers and strategists of Product-Service Systems (PSS) dive into the products' ecosystem with inherently embedded services that exponentially increase the complexity of such systems. In most designs, the Products get the centerpiece, and Services are subsided and not efficiently designed or integrated. [11]

According to [12], the PSSs are mostly suffering from two perspectives 1) the customer value and product functionality do not fit together 2) the process of design of products and services are performed in silos by different departments, which deteriorates the final integrated outcome.

Many publications state clearly that both Product and Service designs need to start in the early stages of the projects and in an integrated manner to deliver a proper Product-Service solution to the customer.[13], [14]

[15] review the benefits of the Product-Service system as well as barriers that currently exist to full adoption of it. The high dependency of the customer on the supplier makes it harder for competitors to challenge the solutions. The customers do not need to own the assets to have access to the products or Services. New Services bring about more revenue for businesses, and finally, PSSs create business sources more sustainable

On the other hand, there should be a mutual trust between customer and supplier to convert from a transactional basis to a long-term partnership, and companies do not have all the required expertise to design value-packed product-Service Solutions. [15]

Moreover, the dynamics of customer interaction are changing drastically. The results of a consulting company [16]survey show that 80% of the global population will have access to mobile technologies, and 60% of those will be smartphones or low-cost tablets. There would be 50 billion connected devices globally by 2020, with mobile being their primary Internet connection channel for individuals.

More than 60% of the operation leaders believe that customer behavior will have a disruptive effect on their organization in the next five years. Almost 2 out of 3 of responders in the same group state that understanding the customer value drivers are already a challenge for their organization. Just 1 out of 4 of the survey responders confirm that their operational capabilities are built to deliver customer value and distinctive experience today and next three years.[17]

Capgemini reports [18] show that the dynamics of customer interaction are changing drastically. A survey conducted by this consulting firm shows that by 2020, 80% of the global population will have access to mobile technologies, and 60% of those will be smartphones or low-cost tablets. There would be 50 billion connected devices globally, with mobile devices being their primary Internet connection channel for individuals.

This revolution in internet accessibility enables firms to have closer contact with their customers and collect more information from customers regarding their needs, challenges, and satisfaction level.

This research is defined based on the gaps that were identified during the literature review. There is a lack of knowledge in quantifying the organization's customer-centricity through maturity levels and developing a model to provide a guideline to drive an organization from a product-centric approach to a customer-centric approach.

This research contributes to the technology management body of knowledge by covering this gap and proposing a novel quantitative method to assess an organization's maturity level in customer-centricity. Besides, this research improves our perception of this discipline and highlights the dynamics of the internal and external factors impacting customer orientation projects in technology management academic research.

On the practical and business level, this research's outcomes offer a quantitative tool and step-by-step framework for evaluating the organizational maturity levels and recommendations of the improvements to develop new capabilities.

Most customer-centricity challenges arise from the fact that organizations begin focusing on customer-centricity after product or service launches to market. The customer-centricity embeds the customer-centric approach in all products and services from roadmapping and design stages. Therefore, the technology management role becomes critical since all products or services (from Technology assessment and roadmapping to product/service innovation) need to have intrinsic customer orientation. The product-centric organizations ignore the role of customer-centricity in their technology management practices, and this research intends to cover this gap in academia and industry.

Most organizations do not have a comprehensive understanding of how much they are customer-oriented, and the assessment of organization executives do not match with the reality in their organization

In addition, the new advanced technologies such as IoT-based platforms and myriad organizational systems, applications, processes, and the restrictions from the policy-making entities build a complex system that necessitates structured assessment and systemic measurement to conclude how much an organization is customer-centric.

In the last few decades, the customers have demanded total solutions from organizations that fulfill their entire need (pain as they see it) without shopping from different vendors and suppliers. The customers prefer to buy products supported with full service and reduce the hassle of matching other products and services and linking different vendors or suppliers. This primary trend in the market motivated the organizations to design products and services in tandem and consider both tangible product and intangible service dimensions of their offerings to the customer.

On the other hand, delivering offerings that include both product and service adds an exponential complexity to new product introductions and also makes it difficult to evaluate how much they are focused on customer needs or, in other words, "how much they are customer-centric."

This research aims to propose a novel method for evaluating an organization's customer-centricity with interweaved product and service deliverables - Product-Service Systems or, in short, PSS. Through this research author intends to design a new maturity model to help the organizations to 1) evaluate the level of customer-centricity as well as 2) provide recommendations that guide them to improve the customer orientation and enhance their level of customer-centricity maturity.

Research Scope

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The ultimate goal of this research is to “develop a quantitative multi-dimensional model to evaluate the maturity of the organization in customer-centricity approach.”

Therefore, this research intends to answer the following questions:

- What are the highest priorities of Challenges, gaps & barriers to adopting and implementing a customer-centric approach in a product-centric organization?
- What are the dynamics among influential perspectives and criteria impacting the maturity of an organization in customer-centricity approaches?
- Is the proposed maturity model appropriate for the assessment of the customer-centricity approach in the organization?
- Is the model generalizable to other industries and applications?

Research Application

When it comes to meeting customers' wants and needs, there is a significant gap between how well companies think they perform and how well they actually do. To understand why things happen, the overall process and underlying causes need to be understood and not just rely on evaluating the outputs and outcomes.

The most successful companies do not just react to problems as they occur; they try to predict and mitigate those problems before they ever happen. Customer-centricity maturity model and score provides the organizations with an instrument to monitor and analyze different organizational dimensions to spot opportunities for improvement regarding their customer orientation

This research developed a decision model that includes a Customer-centricity score and maturity model to evaluate the customer orientation level in an organization. While the case study focuses on E-commerce, the model can easily be applied to any organization with a digital or technological line of business. The Customer-centricity Score can be incorporated appropriately in an assessment methodology.

This tool is a suitable candidate for evaluating the gaps in the organization and a prerequisite for building improvement strategies in a multi-dimensional environment.

The customer-centricity model informs the behavior of the entire organization. Companies that create actual value through customer-centric efforts will automatically have a competitive advantage. Simply, customers will perceive them as

more valuable than other options in the market. The Customer-centricity score in each perspective reveals the weakness, which are great opportunities for improving the organization's customer orientation.

The customer experience (which is a sub-section of customer-centricity) is the company's overall impression from the customer's perspective. It is made up of every single interaction that customers have with the organization, whether it is visible to the leadership or not. This thesis's outcome model can also enhance the customer experience and identify the gaps in and out of the organization.

Chapter Two: Literature Review

Customer-centricity in organization

Customer-centricity is defined as interaction with the customer through various touchpoints and aggregating these relations to build a position for the customer. [2]Experienced marketers know that selling to existing customers is more profitable than new customer acquisition and sale to new customers. The new customers are more likely to switch to another seller or provider and take a long time to turn them into loyal customers who will have more cost. The quality of the products has reached a certain level of saturation in many products, and heavy competition makes the profit margin smaller and smaller. Selling products or services without focusing on customer experience and their real needs shrinks the companies' profit tremendously.

[19]defines customer loyalty simply as "a consumer's intent to stay with an organization." the customer commits to purchase more and various products from the same company and interact positively toward creating more success for the firm through different tools such as recommending them to other customers. [2] Long-term relationships lead to an increase in client confidence about what they can expect to receive from the firm. [20]Different studies reveal that the existing loyal customer is the most profitable ones. [21][22]

In other words, the customer commits to purchase more and various products from the same company and interact positively toward creating more success for the firm through different tools such as recommending them to other customers. [2] More

recently, scholars have begun to consider the importance of managing a firm's customer portfolio as the nature of customer-firm relationships changes. [23]The customer relationship has a massive impact on how much an organization can attract investors. [24]believes that the sum of values of customer relationship is a sign for investors for that purpose.

A customer-centric organization understands the customer's needs and develops capabilities in the company to cover those needs. For instance, a company with a high focus on customer uses the expectation of customer in creating a solution from products and services that delivers specific value to the customer [2]

Besides, Long term relationships between providers and customer is a competitive advantage that is not easy to duplicate, understand and implement for competitors. [1][25]This makes customer-centricity a significant competitive advantage that prevents other organizations from entering a specific market or moving from one company to another.

With all the benefits that customer-centricity delivers, it may seem evident that firms will adopt it as soon as they understand the long-term value of such an approach. However, there are multiple challenges in implementing customer-centricity in organizations that prevent an organization's expeditious and effortless evolution from product-centric to customer-centric.

The main challenge in building an enhanced customer experience is that organizations are mostly designed based on business units, functions, and geographical distribution rather than customer segments and needs. [2]

One of the reasons organizations invest less in customer experience is that they believe they are already customer-centric. [2]The resistance to change in the organization results in making the processes easier internally but making it difficult for the customer to do business with the organization.

The customers interact with the firms through numerous channels, from brick-and-mortar stores to online shopping and social network reviews. The customer journey begins even before they enter the local store or log on to the shopping website, which is a massive change for the companies to cope with. These changes require the firms to take a new initiative to capture, analyze and deploy the customer requirements and needs and provide them with a proper solution, which in most cases is the result of merging different business units and even the external partners.[26]

The integration of the business functions includes but is not limited to marketing, human resources, logistics, IT, service operations and would also involve the external providers and partners. All these efforts are undertaken for the design, creation, and delivery of a positive customer experience. Therefore, the firms' level of complexity to contain all these changes has increased tremendously [27][28], and they need new tools and processes to adopt this enormous change. The researchers' main focus has been on identifying the customer-company touchpoints and

measurement of experience that is delivered to them through each of these channels. [29][30][31] And not much empirical work exists in the literature which directly addresses the customer experience and customer journey. [26]

Schmitt et al. [29] state that every interaction between customer and firm regarding the services result in new customer experiences. This is a very broad definition that includes any customer experience regardless of their nature. It includes all the cognitive, emotional, sensory, social, and spiritual responses to customer and company interaction. [31][32][33]

In almost similar grouping, Schmitt categorizes the customer experiences into sensory (sense), affective (feel), cognitive (think), physical (act), and social-identity (relate) experiences[34].

Verhoef et al. [31] define customer experience as a holistic nature that involves all the customer's cognitive, affective, emotional, social, and physical experiences in response to retailer services and products. The table below shows a summarized view of the literature on customer-centricity and maturity models:

Customer centricity / Customer Orientation	Customer centricity - Management and business model	Exploratory research [35] Literature Review [36], [37] [38]–[40] Empirical Research/Qualitative Analysis [37] Empirical research/ qualitative analysis [38] Case study [35] Conceptual model [41], [42]
	Customer Marketing and CRM	Exploratory research [43] Literature review [44] Empirical Research/Qualitative Analysis [37](CSI) [45]–[47](SEM),[48](CFI, TLI) Case study [35] Empirical research/ qualitative analysis [45], [49](Survey),
	Customer Orientation - Technology Management	Exploratory research [50], [51] Literature Review [50]–[54] Empirical Research/Qualitative Analysis [48], [55](Partial Least Squares), [56](SLR/TRL) Empirical research/ qualitative analysis [49](Survey),[50], [52], [53], [57](Survey), [51], [58](Interview,

		Document analysis), [52](Case study)
IT/Software Maturity		Exploratory research [59][60]–[63] Literature review [61], [64]–[66] [63] (Case study)
Process/Performance Maturity		Literature review [61], [65], [67]–[69]
Organizational maturity		Exploratory research [70]–[75](strategy), [76], Literature review [77](Analytics maturity), [78](applied science)
Maturity Models Meta Analysis		Literature review [79]–[88] Exploratory research [88], [89]

Table 1: Summarized view of the literature

Brand experience is studied in another research by Brakus et al. [29], which is viewed as a subjective and internal response of the customer to the firm's stimuli. The reactions include all the sensations, feelings, cognitions, and behavioral responses to the brand design. McCarthy et al. [90] suggest four categories of sensual, emotional, compositional, and spatio-temporal as "four threads of experience," which let us conceptualize the technology as experience.

The table below presents the evolution of the research focus during the last five decades.

Time Period	1960s–1970s	1970s	1980s	1990s	2000s	2000s–2010s	2010s
Research Focus	Customer buying behavior: process models	loyalty	Service quality	Relationship marketing	Customer relationship management	Customer centricity and customer focus	Customer engagement
Research Area	• Encompassed path to purchase • Broad, experiential focus • Conceptual linkage models • Considered customer experience and customer decision making as a process	• Identified key metrics to begin to assess overall customer • Empirical linkage models to identify key drivers • Assessed and evaluated customer perceptions and attitudes about an experience	• Incorporated atmospherics and environment • Early journey mapping through blueprinting • Linked marketing and operations—focus on quality • Identified the specific context and elements of the customer experience	• Expanded to B2B contexts • Identified key attitudinal drivers • Broadened the scope of customer responses considered in the customer experience	• Enabled return-on-investment assessment • Identification of key touch points and drivers • Data driven • Incorporated multichannel aspects • Identified how specific elements of the customer experience influence each other	• Customer perspective throughout organization • Embedded the customer and customer data deeper into the organization • Focused on redesigning customer experience from customer perspective	• Recognized value of nonpurchase interactions • Incorporated positive and negative attitudes, emotions, and behaviors • Conceptual platform to incorporate social media • More clearly recognized the customer's role in the experience

Table 2: Customer Experience Research Focus Trends (last 50 years)

Customer experience research evolved in the last 50 years, and the focus of the studies and contributions to customer experience has changed tremendously. Lemon et al. [26] identify the subsequent developments in and contributions to customer experience in the six eras.

1960s & 1970s: Initial steps in customer experience and purchase decision making

1970s: Assessment of customer satisfaction and loyalty

1980s: Designing customer journey and Service quality initiatives

1990s: Relationship marketing and expanding the customer experience concepts

2000s: Customer relationship management and impact of business outcomes

2000s-2010s: Business functions integration for delivering positive customer experience

2010-present: Customer engagement and recognizing its role in the experience

In addition, the "Customer-Centric Organization" Search result in Web of Science (2000 - 2021 publications) shows 220% and 507% growth in customer-centric citations for the last 5 and 10 years, respectively, which reveals the gradual interest

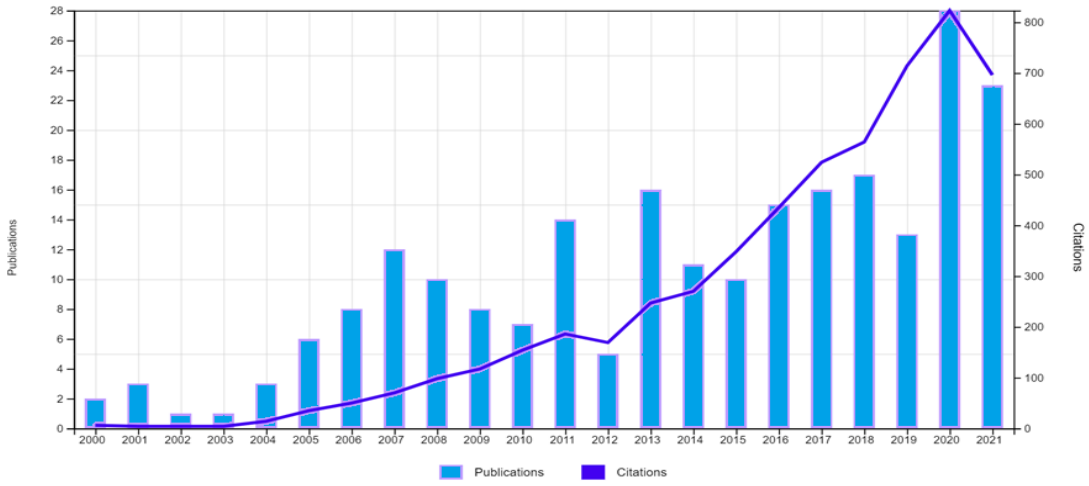


Figure 1: Customer Centric Organization Research during last two decades

in this topic in academic researchers [91]

On the other hand, online searches, which can be related to businesses, show the same trend. Google Trend reveals that the "Customer Experience" keyword search has surged almost 400% during the last decade in Business & Industrial Categories. (Search results between March 2010 and April 2019) [92]

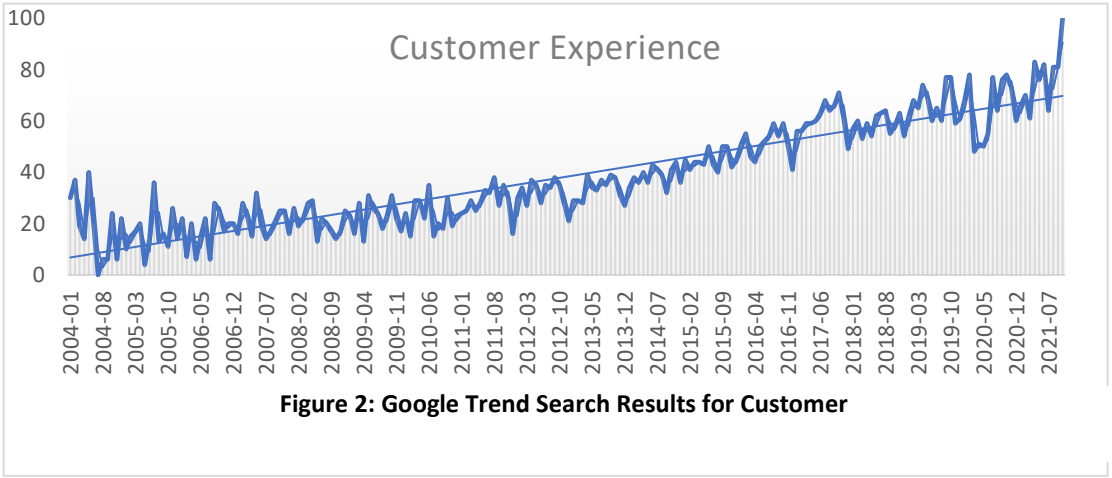


Figure 2: Google Trend Search Results for Customer

Some researchers focus on the customer experiences with technology [90], and some others research on a brand aspect of the offerings [29], but overall there is consensus in the academia and industry that customer experience is a multidimensional concept that involves cognitive, emotional, behavioral, sensory and social components. [34][31]

To define customer-centricity, describing the differences with close concepts is beneficial. Customer Relationship Management is one of the topics that sometimes is confused with Customer-centricity.

CRM is an acronym that stands for Customer Relationship Management. It describes the strategy that a company uses to handle customer interactions and has become synonymous with more focused marketing activities—using intelligence from the database and setting targets to optimize it. However, customer-centricity allows for the customer's empowerment; it helps her do a better job and enables the customer to manage the business relationship, while CRM-as-a-sort-of-marketing does nothing of that kind.

Companies are now talking about customer-centricity rather than Customer Relationship Management (CRM). They are receptive to the idea of creating alignment across the business to ensure consistency in the customer experience, which means developing all the non-IT capabilities as well as the apparent customer relationship management aspects. [93]

Customer Relationship Management has become synonymous with more focused marketing activities—using intelligence from the database and setting targets to optimize it. On the other hand, customer-centricity means how the whole organization behaves towards customers, not just the touchpoints, the decision points, but how the entire business is organized and optimized around the customer's needs. [94]

Croteau and Li [95]state that deployment of CRM tools without understanding their core benefits and the advantages they bring to customer relationships is unrealistic business strategies, and most cases fail to deliver what is expected.

The expectation of the customers regarding how organizations meet their demands has changed tremendously. Customers anticipate the organizations to personalize the products and services for their specific needs and deliver them in the shortest period with competitive quality.

Developing new customer-centric capacities in the organization is a complex problem that requires various resources and strategic alignment. Therefore, experts and practitioners understand that they need a guideline for making decisions regarding new processes, deliverables, and required competencies. This research intends to design a novel maturity model for evaluating an organization's customer-centricity and provide recommendations to enable the companies to move from one stage to a higher maturity model.

The customer-centricity approach delivers high financial and social benefits to the organization. [96] states that most of the research in the field of customer-centricity is driven by the assumption that customer satisfaction/dissatisfaction meaningfully influences the re-purchase of products and services[96]

A notably large number of researches has shown that organizations are more successful when accepting, supporting, and moving toward a customer orientation. [97]

The customer expectation has escalated during the last few years. The customers expect organizations to understand and deliver features, products, or services that are not explicitly requested. They anticipate the proactive involvement of the seller to understand their future needs and requirements. [98]

The main challenge that organizations face is moving away from existing product-centric approaches and delivering what customers are demanding. To achieve this goal, firms need to build new capabilities and processes in the organization. [1]

On the other hand, the research shows that organizations are negligent toward this change in customer expectations. They underestimate, misunderstand or overlook these expectations. [98]

[98] state that proactive customer orientation and being customer-centric are the most consistent customer value drivers in different parts of the world.

Researchers believe that the research community has to explore barriers and issues related to customer-centricity in organizations and suggest new insights to

practitioners and organizations. Shah et al. demand the researchers conduct in-depth research on customer-centric organizations' 4 main barriers: Culture, Processes, Structure, and financial metrics. [79]

Re-organizing a firm around the customer is burdensome for the organizations that have succeeded by product-driven approaches for many years. They need to have concrete evidence for their weaknesses and how they can move away from them [79]. Croteau and Li state customer focus is returning to organizations due to the emergence of electronic business, organizational dynamics, and cultural changes. [95]

The main challenge in building an enhanced customer experience is that organizations are mostly designed based on business units, functions, and geographical distribution rather than customer segments and needs. [2]

One of the reasons organizations invest less in customer experience is that they believe they are already customer-centric. [2]The resistance to change in the organization results in making the processes easier internally but making it difficult for the customer to do business with the organization.

Product-Service Systems

Most of the tools and methodologies that are designed for Product-Service Systems (PSS) development are typically using traditional processes and structures and do not evaluate the actual performance of the outcomes in practice. [99][100][101][102] The process of value delivery does not end when the product starts, and the supplier needs to support the customer until the end of the use of the life cycle of a product with providing further Services. Contrastingly, the engineering processes are mostly focused on the early phases of the product/Service life cycles, and there is not much focus on the mid and end-of-life cycle phases of a PSS. [14][103][104][105][106]–[108]

Most methodologies that are proposed by academia for designing PSS emphasize the importance of the development of the services but are unsuccessful in embedding them in business models, strategies, and operations of the companies. [109], [110]

Compared to physical products, services are generally under- designed and inefficiently developed [109]. Behara and Chase [110] state that ‘‘if we designed cars the way we seem to design services, they would probably come with one axle and five wheels’’. Most publications emphasize the importance of the development of services, but they fail to provide specific assistance on how to embed these services into the strategic and operative management of enterprises.[109], [110]

Most of the engineering processes do not have a clear customer experience management phase in their process steps. [99] suggests a process model for the

development of the Product-System systems, which considers theoretical and empirical aspects of design efforts at the same time.

[111] by means of a multiple case study investigation, provide some guidelines for selecting the most suitable engineering process model for a PSS. [112] Manufacturing companies are getting more interested in the role of services in their business success

From the 1980s that [112] introduced the servitization concepts, the research has grown steadily, which brought to light new topics and research gaps in this field in the last four decades.

[113] categorize the services into three main groups. The base group consists of all services that are provided for the sold goods and products. The intermediate level group of services includes the contact center and helpdesks, which may include maintenance and repair of the products as well. Finally, the advanced services, which service provider provides turnkey services in an agreed level of service (SLA) and fully take responsibility for keeping the performance of the products and services of the customer at a certain level.

The manufacturers adopt servitization for different reasons, but mostly it is because of creating new revenue and profit streams [114]. Other purposes for embracing the servitization include setting barriers for competitors [115], more involvement and loyalty of customers [111], innovation and novelty in products [114], and betterment in responding to the customer needs and requirements [116]

The other categorization comes from the [117], which breaks the services into defensive and offensive. The defensive motivation for the servitization includes cost reduction and creating barriers from infiltration of the competitors, and offensive incentives are business growth and new revenue streams.

There are numerous critical success factors in servitization. A better understanding of the customer behavior and requirements, acceptance and adoption of the new services by customers, understanding and deploying the dynamics of the value proposition, and deep involvement of broader networks in creating the processes. [118]

From the changes that should happen in the processes in the firms to empower them to embrace the servitization, there are a few considerations. For designing new strategies and capabilities, there are two main perspectives: resource-based and dynamic capabilities. The efforts in these approaches are to find the resources and capabilities that enable Service development and utilization. [119]

The advancement of technology introduces novel and creative methods to collect, store and analyze customer-centric information, which will revolutionize these concepts as a whole and in organizations. [79]

Product-service systems deliver total solutions to customers and provide a framework for firms to implement customer-centricity capabilities as well as empowering companies to design the organizational structure, which increases the

rate of success in the transition from Product-centric to Customer-centric organization.

Maturity Model landscape

“A maturity model is a conceptual model that consists of a sequence of discrete maturity levels for a class of processes in one or more business domains and represents an anticipated, desired, or typical evolutionary path for these processes.” [120]The word “Maturity” was coined by Philip Crosby and defined as "the state of being complete, perfect or ready." The maturity model represents a skill or target and a spectrum from initial stages to the highest maturity stage. the maturity models aim to enable organizations to achieve the goals of the processes and organizational excellence. [121]

As can be seen, maturity models have been proposed to address different aspects of different areas and industries. Maturity models are applicable in many various areas such as software, system engineering, project, program, portfolio, and technology management, healthcare technology management, energy technology management, and other areas with goals of improving the processes in the organization [122][123][124][125] [126]

One of the well-known Maturity Models is Capability Maturity Model Integration, which was developed in the 1990s in software engineering. The primary purpose of this Maturity Model was to deliver higher quality software solutions that have been deployed by hundreds of organizations.

There are also maturity models on the project management side, such as OPM3, P3M3, and the project management maturity model (PMMM). The P3M3 and CMMI have the same levels of maturity, except that the first step in P3M3 is awareness instead of initial. The project management maturity model (PMMM) includes a common language, standard processes, singular methodology, benchmarking, and continuous improvement as its maturity levels [124]

Bruin et al. [84] define the maturity model as a conceptual model representing multiple stages of the development of organizational capabilities.

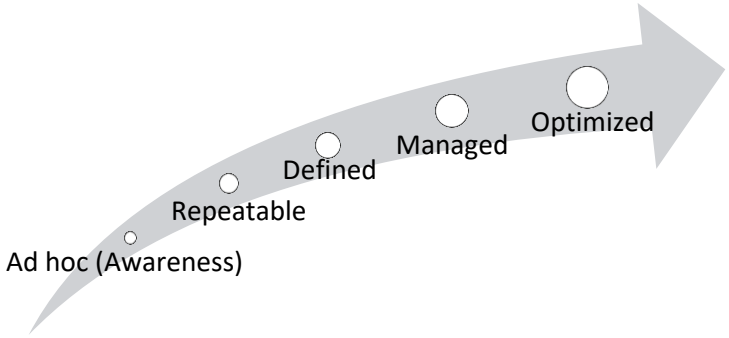


Figure 3: Maturity Level Characteristics

Characteristics of each stage define the maturity levels. Following maturity level characteristics are common among many of the established maturity models: [68], [84]

- Level 1: Initial:

  The processes are unpredictable, poorly controlled, and reactive

- Level 2: Repeatable:

  The processes characterized for projects but still are reactive

- Level 3: Defined:

  The processes characterized for the organization are proactive. The projects tailor their processes from the organization's standards

- Level 4: Quantitatively Managed:

  The processes are measured and controlled with already defined KPIs

- Level 5: Optimizing:

  The focus is on the process improvement and enhancement of organizational performance management

The table below summarizes the most adopted maturity models in the industry.

Maturity Model	Domains	Developer
CMM/CMMI	Software Engineering (CMMI-SW) System Engineering (CMMI-SE) Integrated Product and Process Development (CMMI-IPPD) Supplier Sourcing (CMMI-SS)	*M. C. Paulk, et al., Software Engineering Institute (SEI), (1993), M. C. Paulk, et al. (2006), M.C. Paulk (2009)*
P3M3	Portfolio Management, Program Management, and Project Management	*Office of Government Commerce (OGC), UK (2006)*
Project Management Maturity Model	Project Management	*Harold Kerzner (2001)*

Transmission Resilience Maturity Model	Energy Management	*Pacific Northwest National Lab (PNNL)*
Roadmapping Maturity Model	Roadmapping	*Irene J. Petrick (2008)*
P-CMM (People Capability Maturity Model)	Workforce shaping Performance motivation & management Workgroups & culture building Competency development	SEI (2007)
OPM3 (Organizational Project Maturity Model)	Portfolio Management, Program Management, and Project Management	*Bull (20*07), Project Management Institute (PMI), USA
Cybersecurity Capability Maturity Model (C2M2)	Cybersecurity, Powerplant Management	*Department of Energy (DOE)*
European Foundation for Quality Management (EFQM) Excellence Model	Business Management	*EFQM*
Enterprise Architecture Maturity model	IT Management	*National Association of State CIO's*

Table 3: Most Adopted Maturity Models

According to De Bruin et al. [84], there are three main types of maturity models based on the purpose they serve.

- Descriptive: These models describe the current state of the organization and let the experts come up with improvement recommendations
- Prescriptive: These models, besides the current state evaluation, offer recommendations to improve capabilities.
- Comparative: These models include the initial assessment and relevant recommendations, and the best practices in the sector, which enable the experts to benchmark their organization against it. [84]

In recent years have been different attempts to build a framework for developing the maturity models. For instance, De Bruin et al. [84]propose a framework for designing new maturity models in different sectors. Maier et al. [85] took a structural approach to develop a maturity model. This approach puts forward all the building blocks and elements in designing a new maturity model in the maturity matrix format.

On the other hand, Becker et al. [86]recommend procedural activities to develop a new maturity model mostly derived from design science guidelines.

Salviano et al. [87] suggests an empirical approach that employs the prior accumulative experience of developing maturity models, and finally, Von Wangenheim et al. [88] utilize the knowledge management theory to structure the design on a new maturity model

What is shared among all the above approaches are the initial stages in planning the maturity development:

They all start with the problem statement, stakeholder identification, scoping the target state, and planning toward the goals.

At the second set of activities, they utilized one of the strategies/approaches mentioned earlier to design the maturity models, including the critical capacities, maturity levels, and best practices in each area. Finally, they build the measurement tools that allow for scoring each capability and quantifying the final result.

The below section reviews three different maturity models and their implementation methods to better understand the maturity model structure.

Capacity Maturity Model Integration (CMMI)

One of the most impactful examples of maturity models is the Capability Maturity Model Integration (CMMI) [127], which has already been deployed in over 10,000 companies in 106 countries.[128]

The Capability Maturity Model Integration (CMMI) model focuses on essential elements for effective processes that scientific management pioneers such as Crosby, Deming, Juran, and Humphrey recommended. [129] [130] [131] [132]

In Version 1.3 of the CMMI model [133][134], three interest areas later were merged in CMMI V2.0. These three areas are"

- Product and service development – CMMI for Development (CMMI-DEV),

- Service establishment, management, – CMMI for Services (CMMI-SVC), and
- Product and service acquisition – CMMI for Acquisition (CMMI-ACQ)

The software Engineering Institute believes that the CMMI helps organizations by "providing best practices that enable organizations to improve performance of their key capabilities, providing a clear roadmap for building, improving, and benchmarking capability." [135]

In this model, the best practice for 22 process areas is addressed. [136] These areas include but are not limited to the below-listed items:

- Measurement and Analysis (MA)
- Decision Analysis and Resolution (DAR)
- Organizational Performance Management (OPM)
- Project Planning (PP)
- Validation (VAL)
- Verification (VER)
- Quantitative Project Management (QPM)
- Requirements Development (RD)
- Requirements Management (REQM)

Each Process area has two types of goals: Generic Goals and Specific Goals

The Generic Goals are called "generic" as they show up under different process areas. The Specific Goals are the target state of process maturity, unique to a specific process area.

The third layer of structure in the CMMI is "Practices, " which includes the desired action details to satisfy the requirements.

Finally, the 4th later of CMMI structures are sub-practices that elaborate on practices further. [136]. The below figure illustrates the CMMI model structure.

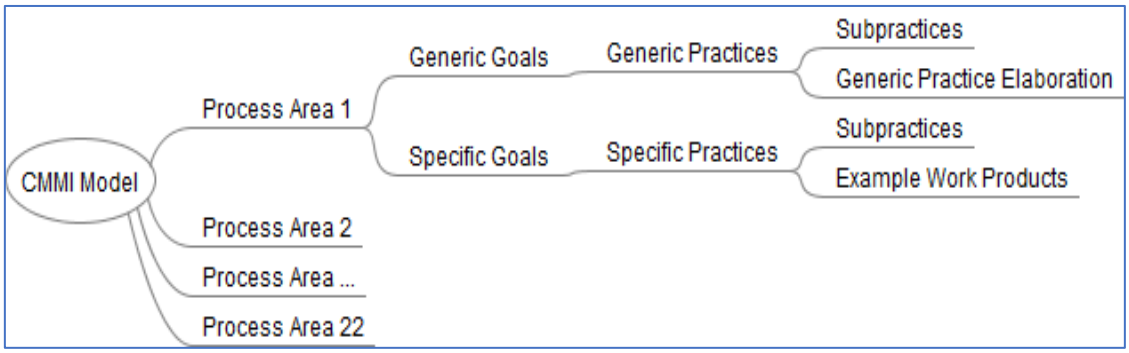


Figure 4: CMMI Hierarchical Structure

According to the CMMI model, the levels are used to describe an evolutionary path recommended for an organization'' process improvement. There are two types of levels in the CMMI model; Capability Levels and Maturity Levels. [136]

The capability levels are used to evaluate and score the goals inside the process areas, and maturity levels are utilized to describe the level of maturity on the process area level. In other words, the maturity model represents the level of process improvement achievement in multiple process areas.

The table below shows the comparison and definition of capacity and maturity levels:

Level	Capacity Levels	Maturity Levels
Level 0	Incomplete	-
Level 1	Performed	Initial
Level 2	Managed	Managed
Level 3	Defined	Defined
Level 4	-	Quantitatively managed
Level 5	-	Optimizing

Table 4: CMMI Capacity and Maturity Level

The figure below illustrates the characteristics of Maturity levels in CMMI: [136]

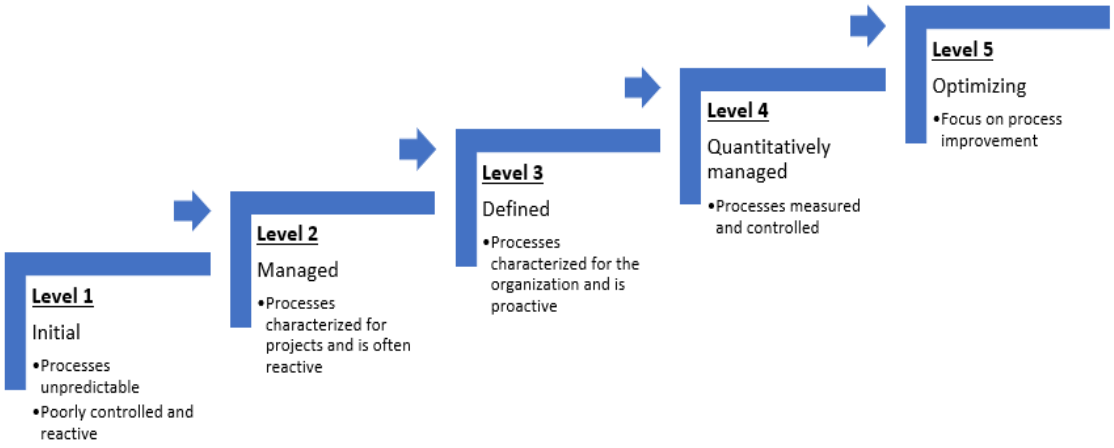


Figure 5: CMMI Maturity Level Definitions

The CMMI tools and structure (described above) aid the experts in evaluating the organization's current state regarding the process area maturity. In the next step, based on the target state that is defined, the CMMI provides a long list of recommendations for improving the organization's capacity and maturity levels.

Portfolio, Program, Project Management Maturity Model (P3M3)

The P3M3 was first published in 2005 by Axelos. It was one of the earliest maturity models in portfolio, program, and project management that has derived most of its characteristics from the CMMI approach. [137], [138]

This model is important because of having a holistic and system perspective rather than just focusing on the organization's processes.

This maturity model is comprised of 3 underlying models:

- Portfolio Management Maturity Model (PfM3)
- Program Management Maturity Model (PgM3)
- Project Management Maturity Model (PjM3).

Similar to the Capability Maturity Model, the P3M3 framework uses five maturity levels.

- Level 1 – Awareness of process
- Level 2 – Repeatable process
- Level 3 – Defined process
- Level 4 – Managed process
- Level 5 – Optimized process.

Each underlying model (Portfolio, Program, Project maturity) is evaluated from seven perspectives, and one of the five levels of maturity is dedicated to them.

Here are the P3M3 perspectives:

- Organizational governance
- Management control
- Benefits management
- Risk management
- Stakeholder management
- Finance management
- Resource management

If we assume the P3M3 as a house, the perspectives build the foundation, and each of the three models is a pillar of it that form the final maturity model[138]

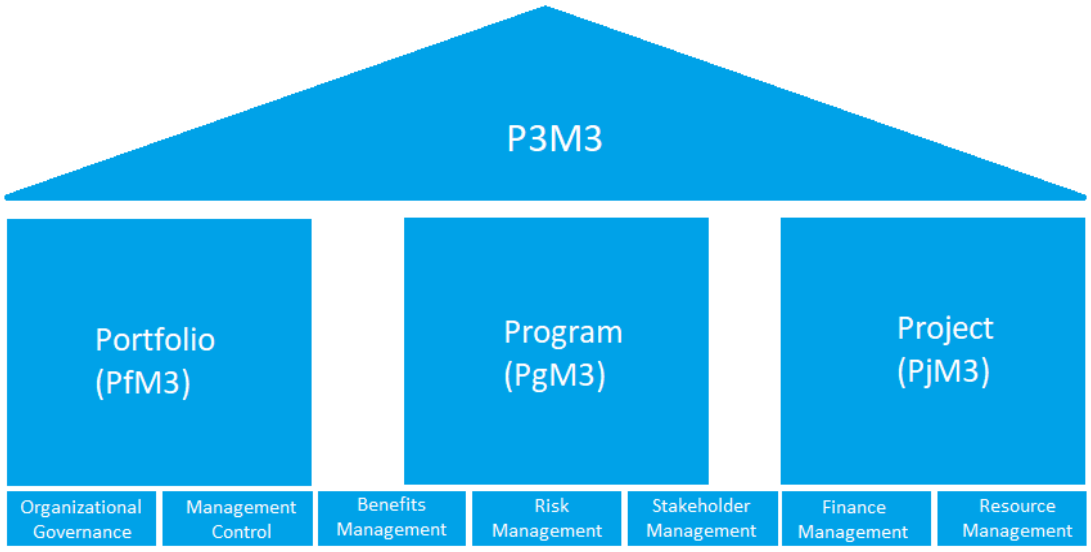


Figure 6: P3M3 Hierarchy of factors

The P3M3 assessment result is delivered from each perspective separately based on levels 1 through 5. Here is a sample outcome of the P3M3 assessment of an organization

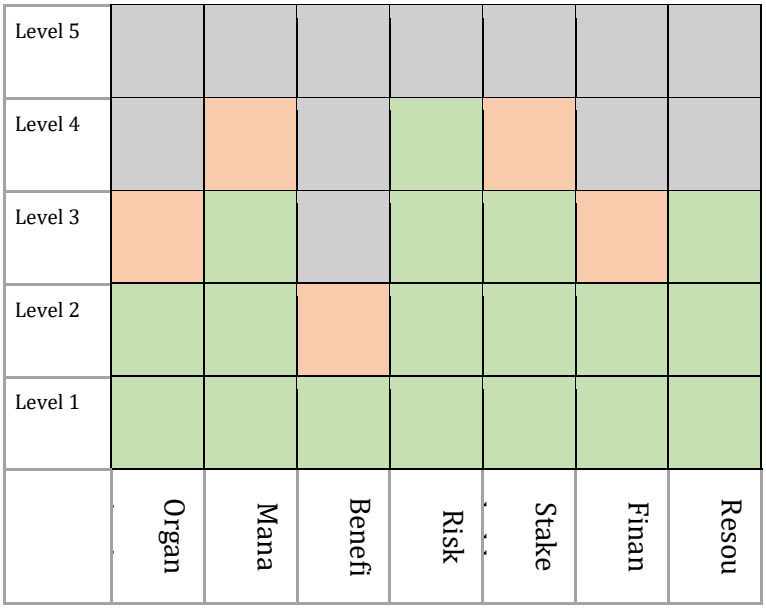


Table 5: P3M3 Assessment Result Table

Legend: Fully meets Partially meets Never

To elaborate on the example, a few of the scores are explained. The "organizational governance" is on "Level 3". In other words, this company they have defined the governance processes, but it is not fully managed. As another example, the company is "Level 4" in the "Stakeholder Management" perspective, which reveals that besides defining the processes, they are managing the processes closely.

The table below (recreated from the Introduction to P3M3 document [138]) defines the characteristics of maturity levels in each underlying model:

Maturity	Portfolio	Program	Project
Level 1	Does the organization's board recognize programs and projects and run an informal list of its investments in programs and projects	Does the organization recognize programs and run them differently from projects?	Does the organization recognize projects and run them differently from the ongoing business?
Level 2	Does the organization ensure that each program and/or project in its various portfolios is run with its own processes and procedures to a minimum specified standard?	Does the organization ensure that each program is run with its own processes and procedures to minimum specified standard?	Does the organization ensure that each project is run with its own processes and procedures to a minimum specified standard?
Level 3	Does the organization have its own centrally controlled portfolio processes, and can individual initiatives flex within these?	Does the organization have its own centrally controlled program processes, and can individually programs flex within these processes to suit the particular program?	Does the organization have its own centrally controlled project processes, and can individually projects flex within these processes to suit the particular project?
Level 4	Does the organization obtain and retain specific management metrics on its whole portfolio of programs and projects as a means of predicting future performance?	Does the organization obtain and retain specific program management performance and run a quality management organization to predict future program outcomes better?	Does the organization obtain and retain specific project management performance and run a quality management organization to predict future project outcomes better?
Level 5	Does the organization run continual process improvement with proactive problem and technology management for the portfolio to improve its ability to predict performance over time and optimize processes?	Does the organization run continual process improvement with proactive problem and technology management for the programs to improve its ability to predict performance over time and optimize processes?	Does the organization run continual process improvement with proactive problem and technology management for the projects to improve its ability to predict performance over time and optimize processes?

Table 6: P3M3 Maturity Levels Characteristics

In order to implement this maturity model, P3M3 recommends a four high-level steps approach: [138]

1. What is the context?

Understand what is the organizational and environmental context for the maturity model and plan according to it.

2. Where are you today?

It is crucial to have a clear understanding of the current state of maturity in the organization to be able to plan for improvement.

3. Where do you want to be?

Necessarily not all organizations need to reach level 5 in each perspective to be efficient and productive. It is essential to make sure that the future state matches the needs of the organization.

4. Did you get there?

The results, as outlined in step 3 need to be evaluated. The gap and divergence from the original plan need to be determined and the next iteration of improvements considered. This cycle continues until the desired state outlined in step 3 is achieved.

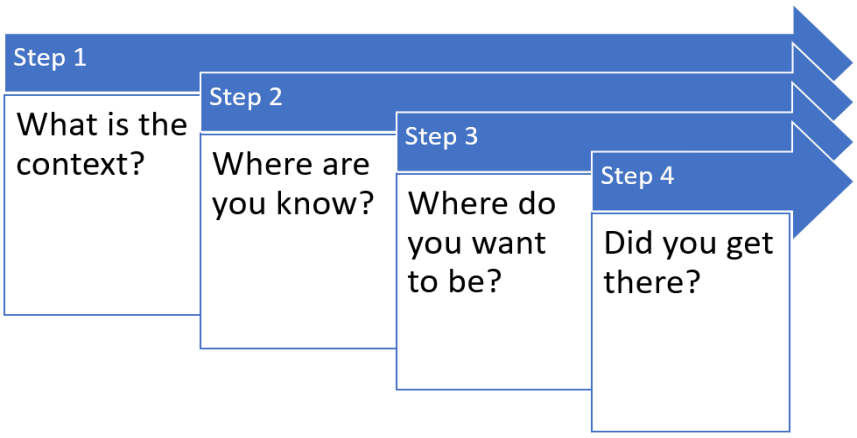


Figure 7: P3M3 Implementation Steps

Pacific Northwest National Lab (PNNL) has devised multiple maturity models to evaluate critical business processes in different sectors and provide recommendations for increasing processes' effectiveness and efficiency. [139]

Here are a few examples of maturity models released by PNNL:

- Electricity Subsector Cybersecurity Capability Maturity Model (ES-C2M2)
- Buildings Cybersecurity Capability Maturity Model (B-C2M2)
- Secure design and Development Cybersecurity Capability Maturity Model (SDD-C2M2)
- Facility Cybersecurity Framework (FCF)
- Transmission Resiliency Maturity Model (TRMM)
- Chemical Security Assessment Model (CSAM)

Contemplating the similarities between these maturity models, one of them is reviewed concisely in the next section to provide a better understanding of the PNNL maturity models.

Transmission Resilience Maturity Model (TRMM)

According to PNNL [140], TRMM is a tool to assess the resiliency of policies, programs, and investments in electricity transmission organizations.

This tool also provides a benchmark for the transmission organizations to evaluate their targets and priorities against best practices in the sector and plan for improvement and enhancement of their capabilities accordingly.

Resilience is defined as "the ability to last different kinds of shocks and survive or readily bounce back," and TRMM focuses on the resiliency of transmission systems and components inside the transmission organizations. This model is (some of other PNNL maturity models) based on the Cybersecurity Capability Maturity Model developed by the Department of Energy [141]. The TRMM evaluates resiliency from nine different perspectives, which are called "domains" [142]

1. Resiliency Program Management
2. Risk Identification, Assessment, and Management
3. Situational Awareness
4. Event Response & Recovery
5. Resiliency Asset Management
6. Information Sharing and Communications
7. Supply Chain and Critical Entities Management
8. Transportation Management
9. Workforce Management

Each domain consists of one or more objectives, which together form the underlying areas of the domains.

The lowest level of the TRMM structure is the practices, which are actionable exercises to achieve each domain's objectives.

Unlike the CMM-based models, TRMM has three levels of maturity, which is defined as follows:

Maturity Indicator Level 1 (MIL1)

Maturity Indicator Level 2 (MIL2)

Maturity Indicator Level 3 (MIL3)

The level of maturity defines each objective in their “Practices.” The TRMM model provides a list of expected maturity levels in each “Practice” that is used during this model's implementation.

The figure below shows the relationship of different TRMM model elements: [142]

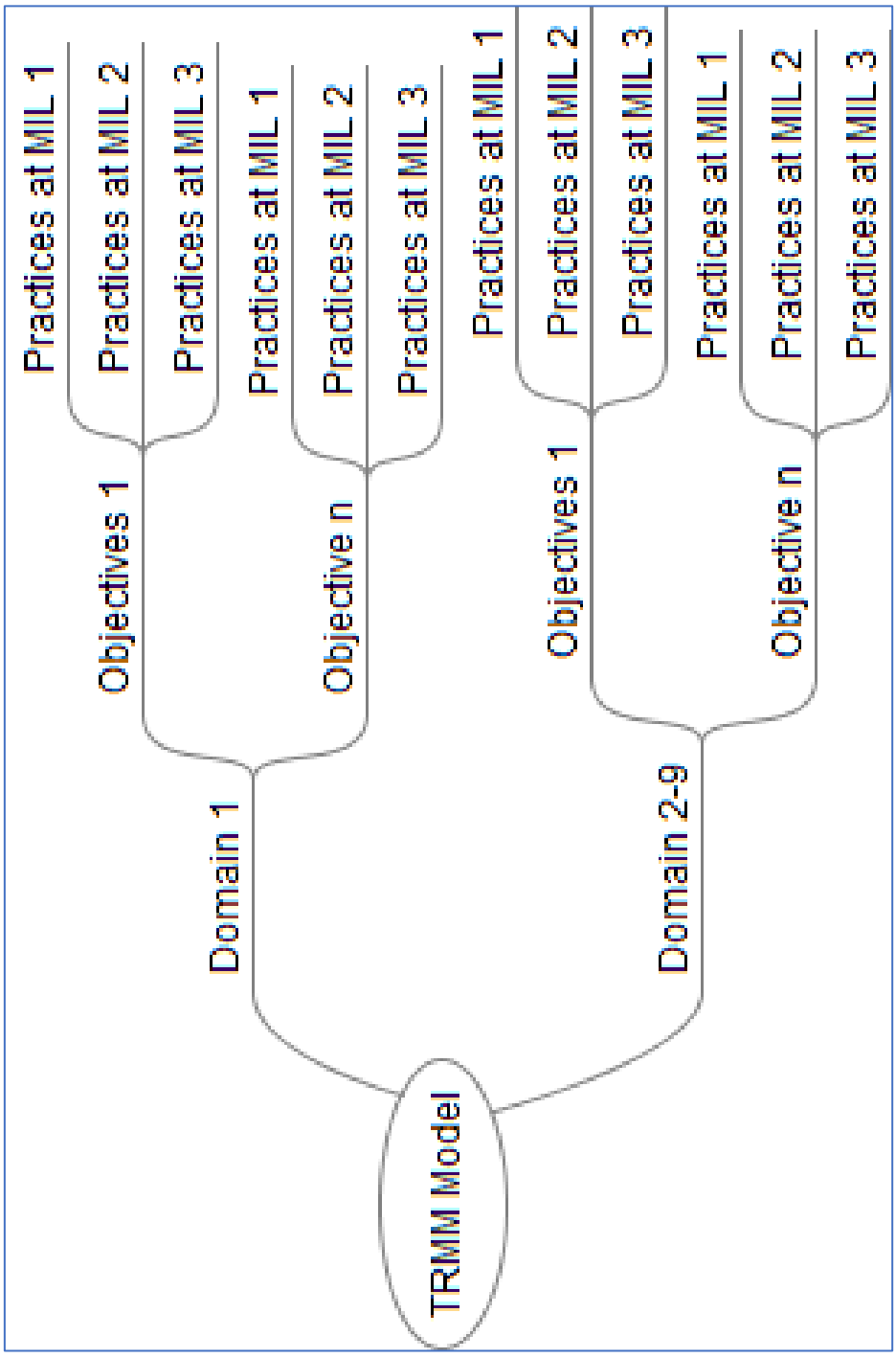


Figure 8: TRMM model elements

- Here is an example of the relationship between domain, objectives, and underlying practices:

- Domains:

  Domain 1: Resiliency Program Management

  - Objectives:

    Objective 1. Establish and maintain a resilience governance structure

    Objective 2. Establish and maintain the resilience program strategy

    Objective 3. Sponsor resilience program activities

    Objective 4. Incorporate resilience in the rate-making/cost recovery process

    - Practices: (Practices for Objective 1:)

      Establish and maintain a resilience governance structure

ID	Practice	MIL
1.1.1	The TBU has an approach to provide program oversight for resilience activities; even if not yet formalized, it is at least done in an ad hoc manner.	1
1.1.2	Management's roles, responsibilities, and accountability for oversight of resilience activities are documented and understood, although that information might be found in several different documents.	2
1.1.3	The TBU's resilience governance and program structure are documented and readily accessible in a single document (e.g., written charter) or a shared information repository (e.g., a web page with links).	2
1.1.4	The TBU's resilience program governance structure is approved by TBU senior management and updated on an organization-defined frequency	3
1.1.5	The governance of the TBU resilience program is part of a larger and comprehensive enterprise-wide resilience program (e.g., a Chief Resilience Officer or senior management has oversight of all enterprise resilience activities).	3

Figure 9: TRMM Domain, Objective and Practice relationship

The PNNL offers an online tool [143] for TRMM evaluation. Users can register and input the model data and export a comprehensive 90-100 pages report with guidelines for improvement to processes and policies. [142]

E-commerce Industry

The electronic data interchange (EDI) made E-commerce possible. [144] The EDI technology was invented in the mid-1960 when companies were attempting to reduce paper consumption, mostly in the retailer and transportation sectors. In the early days of this technology, the EDI was limited to exchanging documents from one computer to another.

Later on, EDI enabled the companies to exchange information, order goods, and perform electronic fund transfers via their computers. [145]Despite ASC regulations (Accredited Standards Committee) in the 1970s, which made this mode of business more trustable, the adoption of EDI was very slow. As Timmers [146]reports, less than one percent of US and European companies adopted it until the late 1990s.

The lower adoption rates were due to the high cost of connecting to EDI connections and frequent technical problems.

The internet revolutionized the dynamics of e-commerce, which enabled the more convenient transaction of goods and services. However, until 1991, NSFNET removed the commercial limitations of using the internet, and the diffusion of e-commerce has soared since then. [144]

After the 2000s, retailing shifted heavily to online and digital transactions, which resulted in more personalized online offerings and marketing approaches, which caused both companies and consumers to benefit from it. [96] [97]

The consumers benefited from the price transparency, which enabled them to compare different goods and services fast and efficiently, which took the producer's pricing power and put it in consumers' hands.

The Producers and retail companies, losing the pricing power, focused heavily on fulfilling the consumers' needs and aimed their competitive efforts toward understanding customers' needs and delivering higher value.

Almost one-third of the world (1.92 billion people) purchased online services and goods in 2019, and it is expected that by 2023, 22% of the total global retail sales will be completed through e-commerce. [149]

E-commerce sales in the retail sector have been soaring during the last few years, and the forecasts reveal that there is no slowing in pace for its growth. From 2014 to

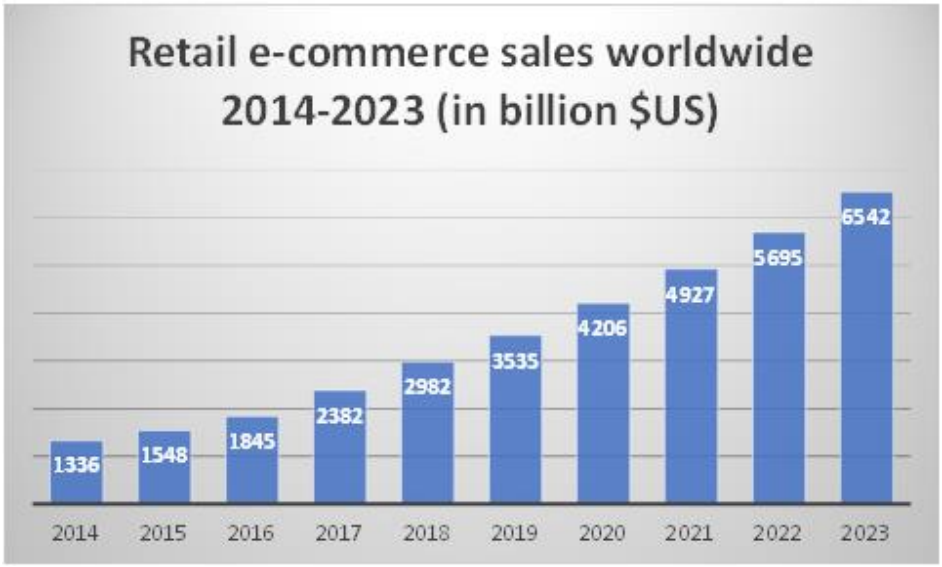


Figure 10: Retail ecommerce Sales Worldwide

2020, retail e-commerce has experienced a staggering 314% increase in total sales worldwide. [150]

The most popular online retail website by unique visitors is Amazon.com, with over 5.2 billion visitors in June 2020. Amazon also leads the market cap leading consumer internet and online services worldwide with a trillion US dollar value. [150]

Figure 11: Most popular online retail websites

It is forecasted that the highest compound annual growth rate (CAGR) of e-commerce in the world's services and goods will be seen in Turkey, Argentina, Indonesia, India, and South Africa. [151]

Figure 12: E-commerce sales CAGR forecast - Map

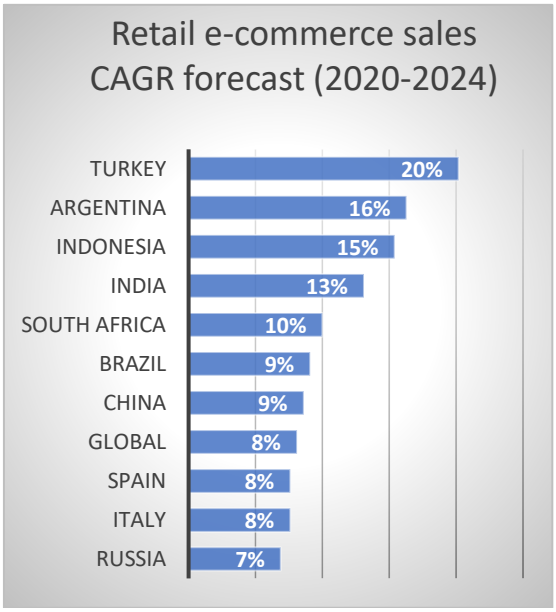


Figure 13: E-commerce sales CAGR forecast - Chart

E-commerce made a long-time desired characteristic of retail business possible: High-level Personalization of the product or service for consumers.

In modern e-commerce strategies, personalization plays an essential role in the success or failure of a producer. They need to build a close relationship with millions of customers in order to understand and address customer personalities, desires, and needs. Producers need to identify the customer, gather information about the customer, process a vast amount of data relevant to an individual customer, and recommend products and services that the customer is probably interested in purchasing.

Risch [152]defines the sole aim of personalization as fulfilling a particular customer or user requirement. According to Mulvenna et al. [153], personalization is the process of customizing or tailoring the products, services, and information to an individual's need. Recommender systems, customization of websites, and adaptive content is also considered as personalization in this research

Technology plays a significant role in expanding e-commerce and will be the primary vehicle to facilitate growth in this sector. Artificial Intelligence (AI) is one of the core technologies that enable organizations to personalize their goods and services for consumers. In a survey performed in 2019 from 158 respondents, 73% stated that the future of personalization of goods and services relies heavily on AI technologies. [154]

In the above literature, all the consumers - disregard the entity type- are considered customers. However, there are five different types of dynamics between supply and demand in e-commerce from entity types;

- business-to-business (B2B),
- business-to-consumer (B2C),
- business-to-government (B2G),
- consumer-to-consumer (C2C) and
- mobile commerce. [155]

Among these dynamics, the business-to-consumer (B2C) is the most well-known shopping method. The consumer commonly pays for the purchase directly via the internet and now orders the products and goods from online channels. [156]

Chen and Dubinsky [157]define customer satisfaction in two different ways:

Instant and cumulative satisfaction. Each transaction between customer and retailer results in an instant customer experience that causes satisfaction for the customer when desirable. Over time, the cumulative shopping experience needs to be considered as it impacts overall customer satisfaction immensely.

Other researchers confirm the above definition of customer satisfaction by describing it as fulfilling requirements, goals, or desires resulting in customers' attitude toward a particular retailer or their emotional response to what they expect and what they get. [158]

Beyond instant and cumulative satisfaction during the shopping interaction, Yen and Lu [159] believe that retailers should expand their communications beyond the financial transaction with high-quality after-sales services and maintain a good relationship with the customer online e-commerce environment.

At the peak of customer satisfaction resides customer loyalty, which is defined as a favorable attitude towards a specific retailer to the extent that leads to repetitive purchases [160]

Olsen [161]believes that satisfaction and loyalty have variable relationships dependent on customer commitment, trust, involvement, and the retail industry. Despite the problematic nature of keeping a customer loyal in the e-commerce environment [162], many researchers indicate loyalty as the principal success factors in online retailing. [163][148]

Perceived value is another critical factor in customer satisfaction, which is modeled by [155]due to the perception of the price against the perceived quality of the product or service.

Perceived quality is emphasized in many research pieces [160], [164], which creates more e-satisfaction and, consequently, more positive outcomes for the e-retailer.

On the other hand, customer satisfaction may be degenerated, and their loyalty is lost due to weaknesses in providing secure, private, and timely services as well as poor website design and using outdated technologies. [163], [165]

The negligence in managing or misuse of customer information has been considered as an invasion of customers' privacy [166]

The privacy of the consumer data is a concern for customers from different dimensions, including unsolicited marketing, price discrimination, exposure of the personal data, identity theft and other criminal activities, and governance surveillance [167]

In recent years, lawmakers have addressed a few privacy and security concerns with comprehensive legislation (such as GDPR in European Union and CCPA in California). In 2020 additional legislation was introduced to address the collection and use of biometric or facial recognition data by e-commerce organizations. As of Jan 2021, over 90 state-wide privacy protection acts are pending approval in 12 States of the United States. [168]

The other factor that impacts the product/service personalization for consumers is the low quality of the data due to careless data collection, intentional false statements, and useless customer profiles. [169]

Chapter Three: Research Scope

Research Gaps

The quality of the products has reached a certain level of saturation in many products, and heavy competition makes the profit margin smaller and smaller. Selling products or services without focusing on customer experience and their real needs shrink the profit of the companies tremendously [2]

The concept of customer-centricity has been around for at least 5o years, and it is not new. In 1954, Drucker stated that “it is the customer who determines what a business is, what it produces, and whether it will prosper.” [170] The survey result from 245 organization leaders in response to the question "Thinking about organizational culture in the digital age, which characteristics do you think are most important in establishing a truly digital-native culture" reveals that 58% believed that customer-centricity ranks on top of other impacting factors. [171]

Although customer-centricity seems to be easy to discuss, organizations struggle to build and sustain it in their large organizations [172]

Galbraith believes managers seem to be running product-centric firms with merely a cosmetic gloss of customer focus sprinkled around the edges. [2]

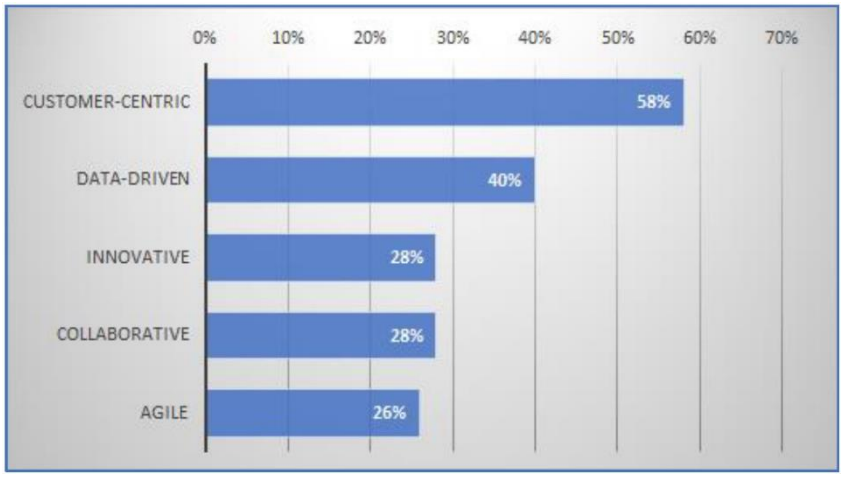


Figure 14: Importance of Impacting factors on Customer Centricity

Re-organizing a firm around the customer is burdensome for the organizations that have succeeded by product-driven approaches for many years. They need to have substantial evidence for their weaknesses and how they can move away from them [79]. Croteau and Li state customer focus is returning to organizations due to the emergence of electronic business, organizational dynamics, and cultural changes. [95] The prominent challenge organizations face is moving away from existing product-centric approaches and delivering what customers are demanding. To achieve this goal, firms need to build new capabilities and processes in the organization. [1]

A paradigm shift in management approaches is discussed in different research works, suggesting a change from product-based strategy to customer-based strategy. [173]

Figure 15: Paradigm Shift in Strategies of Organizations

However, developing new organizational capacities is a complex problem that requires various resources and strategic alignment. Therefore, experts and practitioners understand that they need a guideline for making decisions regarding new processes, deliverables, and required competencies. [174]

The maturity model defines skill or target and a spectrum from initial stages to the final maturity stage. the maturity models aim to enable organizations to achieve the goals of the processes and organizational excellence. [175]

On the other hand, [121] believes Maturity Model design methods are an emerging topic in academic literature. Reviewing the widely used maturity models reveals that they are based on practice and experience from previous projects completed successfully. These methods lack a solid theoretical foundation and academic research method. Besides, a systematic approach in building maturity models is essential as the number of proposals and models to build them increases day by day.

Mettler and Rohner [175]Found 135 different maturity models related to information systems and platforms. in another study, Bruin et al. found 150 different models

evaluate the IT capabilities strategies alignment of innovation management, program management, knowledge management, and enterprise architecture [84]

The methods that exist mostly focus on one or a handful of organizational dimensions. For instance, Von Waigenheim et al., [88][176]propose a method that focuses on knowledge management. In another study, Salviano et al. [87]offer a technique for developing Maturity models based on the organizations' previous experience in developing maturity models.

Garcia-Mireles et al. believe that new technologies and novel customer needs demand changes in firms' processes and structure. Although well-known maturity models such as CMMI and ISO/IEC 15504 are widely used in industry, they need to be customized based on organizational needs and require long-term strategic plans to enable them to achieve short-term goals. [121]

Shah et al. believe that the research community must explore barriers and issues related to customer-centricity in organizations and suggest new insights to practitioners and organizations. Shah et al. demand the researchers conduct in-depth research on customer-centric organizations' 4 main barriers: Culture, Processes, Structure, and financial metrics. [79]

Also, the technologies have changed tremendously, which impacts how firms interact with customers. Mobile devices, Social media, the cloud, the internet of things, and artificial intelligence have largely influenced firms' customer-centricity approach adoption. [5]

In most of the literature, researchers focus on one or a few areas to develop the Maturity Model. However, this research proposes a multi-criteria maturity model for organizations focusing on product-service systems that were not addressed before.

De Bruin states that there is little research and documentation on developing maturity models widely accepted, reliable and sustainable [84]. In most academic literature, researchers focus on one or a few areas to develop the maturity model. There is inconsistency in the methods used and limited to the researcher's experience in specific fields, and the exhaustive list of criteria was limited to the industry and sector studied.

[177]believes in order to improve customer experience, service providers must first be able to measure and model customer experience effectively.

Research Gap	References

Current Maturity Models focus mostly on Engineering Capabilities, strategic planning, and project management, and customer-centricity was not directly considered in the evaluation models. The existing maturity models do not address the measurement of customer-centric maturity level in organizations from a multi-dimensional perspective.	[62],[121],[88], [176],[87], [123], [178], [179], [180], [84],[181],[122],[182], [79],[171]
The literature review reveals that Critical Success Factors and dynamics of internal and external elements are identified, reviewed, and proposed based on the Product-Centric approaches in organizations. Therefore, in the proposed factors, the organizational capabilities in products and service design received more attention than customer needs and experiences. Besides, products-services systems are not considered in tandem with the customer experience and organizational capabilities, Project Management, Strategic Planning, and new revolutionary technologies (i.e., AI, IoT). Multiple researchers demand the researchers conduct in-depth research on the main barriers to transition	[1], [17], [79], [2], [5], [18], [62], [121], [88], [176],[87],[75], [76], [77]

from product-centric to customer-centric approaches in organizations.	
Most researches focus on the qualitative factors (e.g., CFSs) in achieving a Customer-centricity approach in organizations. However, they failed to propose quantitative methods to evaluate the organizations' maturity models or provide quantified analysis and assessment of the organization's current and future state concerning customer-centricity approaches.	[174], [79], [5], [177], [179],[183], [184], [185], [186], [187]

Table 7: Research Concepts and Gaps

Research Questions

Through the literature review, multiple gaps are recognized, which was presented in the previous section. In order to cover those research gaps, the research goals and questions are defined as follows:

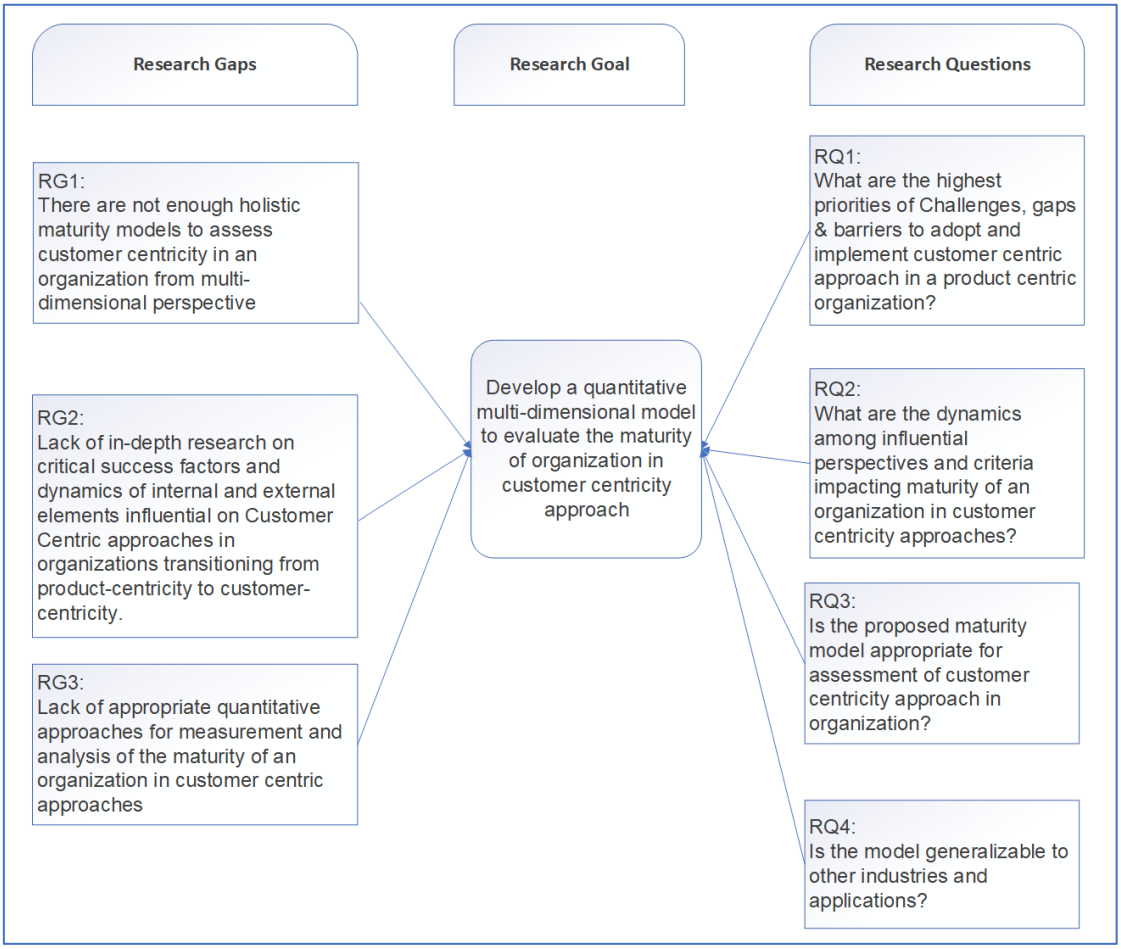
Research Goal

- RG: Develop a quantitative multi-dimensional model to evaluate the maturity of the organization concerning the customer-centric approach

Research Questions

- RQ1: What are the highest priorities of Challenges, gaps & barriers to adopting and implementing customer-centric approaches in a product-centric organization?
- RQ2: What are the dynamics among influential perspectives and criteria impacting an organization's maturity in customer-centricity approaches?
- RQ3: Is the proposed maturity model appropriate for the assessment of the customer-centricity approach in the organization?
- RQ4: Is the model generalizable to other industries and applications?

Figure 16: Research Gaps, Goals, and Questions



Chapter Four: Research Methodology

Chapter four of this research presents the methods and prerequisites for constructing a maturity model that integrates organizational and market factors. The research's side consideration is to provide a complete understanding of how emerging technologies can be developed in ways that competition in both product and service fronts is possible.

Overview of Multi-criteria Decision Models

Analytical Hierarchy Process (AHP)

AHP introduced by Thomas Saaty [188] is very similar to the HDM model basic concepts. Both provide a model for multi-criteria decision-making through pairwise comparison. The pairwise comparison refers to the practice that Each of the respondents has to compare the relative importance between the two items under a specially designed questionnaire. [188]

Besides, both AHP and HDM are structured techniques for organizing and analyzing complex decisions based on mathematics and psychology. AHP provides a comprehensive and rational framework for 1) structuring a decision problem, 2) representing and quantifying its elements, 3) relating those elements to overall goals, and 4) evaluating alternative solutions.

On the other hand, the main difference between HDM and AHP is that HDM uses constant-sum calculations, and AHP applies Eigenvectors. Other than that, most steps and calculations follow a similar practice.

Analytic Network Process (ANP)

Saaty introduced this multi-criteria decision-making method as a generalization of the AHP method [188]. AHP and HDM assume that each element in the criteria is independent of the other elements, and the hierarchy goes in one direction. ANP, on the other hand, allows dependency and bidirectional flow; hence can be used in situations where this is the case. It does that by forming a control hierarchy, strategic criteria, clustering criteria, supermatrix, and submatrices. [188],[189]

Preference Ranking Organization METHod for Enrichment of Evaluations (PROMETHEE)

This multi-criteria decision method was introduced by Brans in the early 1980s [190] PROMETHEE is more focused on the ranking of alternatives and assumes the weights for the hierarchy were established beforehand. PROMETHEE has six options allowing the user different ways to express meaningful differences by minimum gaps between observations.

The initial version of PROMETHEE was developed to show only the best alternative based on the positive and negative flows, later versions of the method show the rank of all options, and they are based on multicriteria net flow with consideration of indifference and preference thresholds [190]–[193]

Technology Acceptance Model (TAM)

According to Davis [194], TAM: "specifies the causal relationships between system design features, perceived usefulness, perceived ease of use, attitude toward using, and actual user behavior." This method focuses on the factors affecting user's decision to accept new technology

by focusing on the factors that affect the “Perceived usefulness” and “Perceived ease-of-use” of new technology [194]–[196]

Technique for Order of Preference by Similarity (TOPSIS)

Technique for Order of Preference by Similarity (TOPSIS): TOPSIS method is a multi-criteria decision-making method. TOPSIS determines the ideal solution and the negative-ideal solution. The ideal solution maximizes the benefit criteria and minimizes the cost criteria, whereas the negative ideal solution maximizes the cost criteria and minimizes the benefit criteria. TOPSIS then selects the alternative with the shortest distance from the ideal solution and the farthest distance from the negative ideal solution as the best alternative. [197]

TOPSIS basically uses an aggregation function to represent closeness and distance from reference points. [198][199][200]

ELimination and Choice Expressing Reality (ELECTRE)

The ELECTRE method, in which the criteria of the set of decisional alternatives are compared utilizing a binary relationship, defined as ‘outranking relationship,’ is more ‘flexible’ than the ones based on a multi-objective approach.

ELECTRE method provides a different approach. This method concentrates the analysis on the dominance relations among the alternatives. That is, this method is based on the study of outranking relations, exploiting notions of concordance [201][202][203]. These outranking relations are built in such a way that it is possible to compare alternatives. The information required by ELECTRE consists of information among the criteria and information within each

criterion [201]. The method uses concordance and discordance indexes to analyze the outranking relations among the alternatives. [202]

Multi-Attribute Utility Theory (MAUT)

MAUT allows the decision-maker to quantify and aggregate multiple objectives even when these objectives are composed of conflicting attributes [204], [205]. The decision maker's preferences are modeled in order to obtain a multi-attribute utility function, for instance

U(ci,ti,di)

This function aggregates utility functions for all criteria or attributes. That is, an analytical function is obtained, which combines all criteria through a synthesis function. Each particular analytical form for this function has preferential independence conditions to be evaluated to guarantee that the decision maker's preferences are [204], [206]

AHP vs. MAUT vs. HDM

Since its development three decades ago, the AHP has become a widely popular MCDM procedure in the US and other countries. AHP provides a model for multi-criteria decision-making through pairwise comparison. This is a structured technique for organizing and analyzing complex decisions based on mathematics and psychology. The main benefit of AHP is that it provides a comprehensive and rational framework for structuring a decision problem,

representing and quantifying its elements, relating those elements to overall goals, and evaluating alternative solutions.

However, the data required for this method needs experience, judgment, and knowledge to be utilized. Besides, AHP implementation does not consider the risks and uncertainty that are inherent to decision-making models. The main weakness that researchers debate in the AHP method is the measurement scale, rank reversal, and preferences' transitivity. [207]

The main advantage of MAUT is that it lets the decision-maker quantify and aggregate multiple objectives even when these objectives are composed of conflicting attributes and form a multi-attribute utility function.

A multi-attribute utility (MAU) function is applied to illustrate an agent's preferences about the product bundles either in situations with specific results or when there is uncertainty involved.

The Literature continuously criticizes MAUT's axiomatic base and related application issues. For instance, [208]argues that "the [decision making] subject systematically make choices that violate properties required by the expected utility."

Also, other decision-making researchers [209], [210] state that "The conclusion is that the justification of the practical use of expected utility decision analysis as it is known today is weak."

For the case study of e-commerce, it is essential to be able to tailor this process to capture all nuances of technologies, products, services, and markets.

However, a clear and comprehensive set of methods is required to study this problem in detail. Therefore, this research's key goal is to propose, explain, and implement a set of methodologies that is appropriate for improving understanding in this area.

Hierarchical Decision Model

The hierarchical Decision Model (HDM) is a decision-making tool that ranks the alternatives and evaluates those choices to distinguish the best among them. [211]

This is an MCDM method which was developed by Kocaoglu [212] with the same concept as the Analytical Hierarchy Process (AHP) methodology, but using a different pairwise comparison scale [213]and judgmental quantification technique and enables to analyze of the complex problem through quantifying the alternatives and also embedding the qualitative judgments into a decision model [214].

HDM uses a hierarchical disposition model to visually illustrate the impact of perspectives, criteria, and sub-criteria on the ultimate objective. The model consists of 5 levels: mission, Objectives, Goals, Strategies, and actions (MOGSA). These levels are not fixed or limited but flexible to match the actual requirements of any case under study. Determining the number of hierarchical levels depends on how simple or complex the decision problem is. This method's application and robustness are proven in different areas such as Risk Assessment, Investment Analysis, Resource Allocation, Medical and Health care decisions, and Energy Choices [215], [216].

HDM is used frequently to capture complex and multi-criteria problems in academia and industry. The method provides a mechanism to illustrate the relationship between different perspectives, criteria, and ultimately decision model factors. [217]

The hierarchical Decision Model allows the researcher to collect the subject matter experts' feedback and build a quantitative model based on a pair-wise comparison of the impacting factors. The relative weight of the factors represents the importance of the factor in decision making and the level of impact in selecting between alternatives. [188]

The Hierarchical model decomposes a complex problem into its elements. Besides, the pair-wise comparison is more comfortable to digest and understand than the absolute impact of a single factor on a complex issue. The human brain can only process a certain number of items simultaneously. The pair-wise comparison of the factors allows the experts to focus only on two factors simultaneously and use their brainpower to make a much simpler decision rather than comparing dozens of elements simultaneously. This makes the experts more comfortable during decision-making processes. [217]

To design a maturity model, the researcher needs to select a methodology that enables him/her to quantify the expert judgments and conclude on the level of maturity of an organization in certain factors. Many of the existing maturity models are products of companies, reports, and/or whitepapers, which means they have not been through a peer-reviewed process and, more importantly, validation. In addition,

creating a new maturity model is a complex and multi-dimensional activity, and the methodology used for developing it needs to simplify this complexity.

The methodology used to address the gaps in the literature need to possess the following attributes:

- **Decomposition:** Decomposition allows the researcher to break down the problem in impacting factors that reduce its complexity.
- **Quantification:** the selected methodology needs to quantify the criteria under analysis to allow building a mathematical model.
- **Validation and re-usability:** The method needs to equip the researcher with some validation tools to enhance the model's accuracy. Also, the model should be re-useable by different researchers and practitioners.

After reviewing several other models that are used in multi-criteria decision-making, it is found that the HDM methodology can adequately tackle the gaps mentioned above. HDM is indeed a multi-criteria decision-making method with a hierarchical structure that enables a more complex analysis through pairwise comparing the important factors (perspectives/criteria) in a certain problem/decision. Furthermore, HDM captures experts' judgments and turns them into the weights for important factors regarding the problem.

The HDM model is used for the following purposes:

- Structure the impacting criteria and perspectives concerning customer-centricity score
- Validate the impacting criteria and perspectives through an expert panel
- Quantify criteria and their level of impact on the final goal (level of the customer-centricity)
- Reveal any disagreement or inconsistency in the judgments of the expert panel
- Use desirability curves to quantify subjective measures and identify the level impact of each factor on the final goal (level of customer-centricity)
- Determine the level of sensitivity of customer-centricity to each impacting factor

This data collection can be done anonymously and individually, boosting data quality to help the decision-maker. Different kinds of analysis, such as Inconsistency analysis and Disagreement analysis, can be done to validate expert judgments when using HDM.

Moreover, at each level of the hierarchy, surveys/questionnaires/interviews can be used to validate the selected perspectives/criteria (initially found using literature review).

In addition, Sensitivity Analysis provides the decision-makers with a better understanding of the model in terms of flexibility. At the same time, it gives them a better idea of when the model would require an update. Finally, although a heavy load of quantification may go into the quantification, validation, and calculation of the results, HDM results are intuitive and not difficult to use/understand by people who have a less academic background.

HDM methodology quantifies the experts' input, and desirability curves clearly illustrate the level of maturity in the organization. The desirability curves allow the measurement of each criterion influential on the final result (score).

Inconsistency in Hierarchical Decision Model

In the HDM model, the disagreement among one expert's evaluations is referred to as Inconsistency.

Estep defines the Inconsistency as "generally, inconsistency can be defined as disagreement within an individual's evaluation" [218]

From another perspective, Abotah mentions that "inconsistency is a measure that explains how reliable and homogeneous in his or her answers each expert was through the whole questionnaire" [219]

There are two types of Inconsistency analysis: Ordinal and Cardinal.

The Ordinal Inconsistency reveals the logical inconsistency, and Cardinal Inconsistency shows the magnitude of it as well. An example helps with the elaboration of these concepts.

For instance, given three factors A, B, and C, if A is better than B and B is better than C, A must be better than C if one is to be logically consistent if it is stated otherwise (e.g., C is better than A) researcher concludes that there is an **Ordinal Inconsistency**.

Given the same three factors of A, B, and C, if A is three times better than B and B is two times better than C, then A must be six times better than C; otherwise there is **Cardinal Inconsistency** an individual's evaluation.

According to Gibson, when subject matter experts need to make multiple decisions and compare among different items, the research should expect inconsistency occurrences. [220]

In HDM, inconsistency is measured by calculating the sum of the standard deviations. Hence, inconsistency can be measured by the variance of relative values.

Phan (2013) summarized the equations as follow:

$$\frac{1}{n!}\sum_{j=1}^{n!} rij$$

- rij: relative value of the i element in the j orientation for an expert
- $\bar{r}_i$: mean relative value of the i element for that expert

Inconsistency in the relative value of the i element is

$$\sqrt{\frac{1}{n!}\sum_{j=1}^{n!}(\bar{r}_i - r_{ij})^2}$$

for i=1, 2, …, n

The variance of the expert in providing relative values for the n elements is

$$Inconsistency = \frac{1}{n!}\sum_{j=1}^{n}\sqrt{\frac{1}{n!}\sum_{j=1}^{n!}(\bar{r}_i - r_{ij})^2}$$

To overcome the Inconsistency in the HDM model, the researcher either needs to ignore and drop the Expert's input with Inconsistency or need to follow up and ask

for further information and seek more clarity to understand if the Inconsistency is valid and input of the Expert need to be considered.

Since the Inconsistency is expected, there should be an acceptance range to verify the expert's input. According to Kocaoglu [212][220], the acceptable level of Inconsistency level is 10% percent. In other words, if the Inconsistency exceeds this level, the researcher needs to be very cautious about accepting the expert's judgment. In this case, the researcher needs to either discard the expert judgment or collect their input again through repeating their pair-wise comparisons. [220]

Abbas [221] formulated a new method of calculating the Inconsistency in case the inconsistency level is higher than recommended 10%.

He used root-sum of variances (RSV), which injects the number of pair-wise comparisons into the inconsistency calculation. In other words, when the number of pairwise comparisons increases, the range of inconsistency is adjusted accordingly with his method. [221]

Here is how the RSV method calculates the inconsistency:

$$RSV = \sqrt{\sum_{i=1}^{n} \sigma_i^2}$$

Where:

HDM inconsistency = Root of the Sum of Variances (RSV)

Where the variance is calculated through

$$\sigma_i = \sqrt{\frac{1}{n!} \sum_{j=1}^{n!} (x_{ij} - \bar{x}_{ij})^2}$$

Where mean of the normalized relative value of the variable i for the jth orientation is

$$\bar{x}_{ij} = \frac{1}{n!} \sum_{j=1}^{n!} x_{ij}$$

The Disagreement in HDM occurs when the input data of experts disagree with each other. In other words, subject matter experts evaluate the impact of factors differently from other experts on the panel.

Abotah states, “the disagreement of experts can be understood as the deviation of their judgments from each other” [219]

While experts are invaluable to assigning values to decision attributes, their input is subjective, resulting in disagreement among the experts.

The Disagreement analysis is important from the model reliability perspective. With this analysis, the researcher quantifies and reveals the disagreement among the experts. As [219]states, if the researchers do not perform disagreement analysis on their input data, they would face problems during the decision analysis. [219]

When a disagreement shows up in the HDM model, the researcher needs to follow up with the experts who provided different opinions and further elaborate on their input. The researcher needs to confirm with the expert that they have fully understood the intention of the question correctly.

If the expert confirms and insists on their input to be correct, the researcher needs to keep their input and explain the discrepancy in their calculation. In extreme cases, the removal of those outliers from the pool of experts could also be contemplated.

According to Estep [218], this disagreement has roots in experts' personal and professional experiences. Therefore, to ensure that all experts can fully understand

the survey questions and respond correctly, the questions need to be written without ambiguity and in the most straightforward way.

According to Gibson [220] and Iskin [222], the disagreement is calculated as follows:

Let

m: The number of experts, k= 1 … m

n: The number of decision elements, i=1 … n

r#.: The mean relative value of the i-th element for k-th expert

R#: The group relative value of the i-th element for m experts is

$$R_i = \frac{1}{m}\sum_{k=1}^{m} \bar{r}_{ij}$$

for i = 1, 2, …, n

The Disagreement among the m experts for n decision variables is:

$$d = \sqrt{\frac{1}{n.m}\sum_{k=1}^{m}\sum_{i=1}^{n}(R_i - \bar{r}_{ik})^2}$$

As mentioned in previous sections, the acceptable threshold for Disagreement is 10% (or d=0.1) [218] [219] [222][220]. If the Disagreement above this threshold is noticed, the researcher needs to take action to resolve the issue either by eliminating the Expert or analyzing and discussing the reasons to understand the reason behind it.

Researchers have recommended different methods for the disagreement analysis.

Iskin [222] and Gibson[220] suggest Hierarchical Agglomerative Clustering (HAC), which iteratively puts the experts with similar opinions in a cluster. The grouping continues to build as many clusters (groups) needed to lower each cluster's disagreement levels to an acceptable level. In this method, the clusters inside the expert panels are illustrated with dendrograms to reveal different groups and sub-groups of opinion.

The other method for measuring disagreement among experts is the statistical F-Test. F-test is defined as a test for the equivalence of the variances of two experts or people having normal distributions. It is the ratio of the variances of a sample of observations taken from each. [223]F-test uses the null hypothesis, which indicates no association or significant disagreement among experts [224]. The F-values and F-critical values of the pairwise comparisons are provided readily by the HDM software supplied by the ETM department. The F-value of a pairwise comparison procedure is calculated

and compared against the F-critical value of the procedure to determine whether the Null Hypothesis can be rejected or not.

F-test is a statistical test that is mostly used to decide if a statistical model as a whole is significant and is a best fit for a set of data using the least squares [217], [218], [225], [226]. In this approach, F-test is used to determine whether r_{ic} is equal to zero. The null hypothesis is defined as follow:

Let r_{ic}: Intraclass Correlation Coefficient (see equations 3.2 to 3.14)

MS_{BS}: Mean square between decision elements.

MS_{res}: Mean square residual

Null Hypothesis: $H_0 : r_{ij} = 0$

Alternative Hypothesis $H_a : r_{ic} > 0$

The F value is computed as follow: $F_{BS} = \frac{MS_{BS}}{MS_{res}}$

F-Critical is the critical F-value the statistic must exceed to reject the test. In this case a significance level of 5% (α = 0.05) is considered. So, the hypothesis test would be:

If $F_{BS} > F_{critical}$ at α = 0.05 then $H_0$is rejected.

In order to analyze the impact of potential future changes in HDM, Sensitivity Analysis is conducted. In simple words, Sensitivity Analysis runs different what-if scenarios on each element and reveals how a model depends on a specific factor or element. The main objective of performing Sensitivity Analysis is to evaluate how the uncertainty impacts the model's outcome and find the allowable range at the perspective or criteria levels, called the model's tolerance. In this manner, the researcher can test the robustness of the HDM model.

The other use case of sensitivity analysis is to determine the impact of expert disagreements on the final decision model. If there is disagreement in the expert panel, sensitivity analysis can measure the significance of the disagreement and reveal the depth of it to the researcher.

There are two approaches to applying Sensitivity Analysis, including the **local Sensitivity Analysis** approach and the **global Sensitivity Analysis** approach. In the local Sensitivity Analysis approach, the focus is on varying inputs one at a time while holding the others fixed to a nominal value.

To calculate the allowable range for changes in the values that do not impact the final outcome of the model, [215] proposed the following calculation:

For the perturbation p_i^c (the perturbation affecting one of the objectives) where:

$$-C_{l*}^C \leq p_{l*}^c \leq 1 - C_{l*}^c$$

The original maturity score (ranking) will not be subject to change if:

$$\lambda \geq P_i^c . \lambda^c$$

Where:

$$\lambda = C_r^A - C_{r+n}^A$$

And:

$$\lambda^c = C_{r+n,l*}^{A-C} - C_{rl*}^A - \sum_{l=1,l\neq l*}^{L} C_{r+n,l*}^{A-c} \cdot \frac{C_l^c}{\sum_{l=1,l\neq l*}^{L} C_l^c} + \sum_{l=1,l=l*}^{L} \frac{A_{rl}^{A-c}}{\sum_{l=1,l\neq l*}^{L} C_l^c}$$

The top choice will remain at the top rank if the above condition is satisfied for all r=1 and n=1, 2… I-1. The rank order of all Ai's will not change if the above condition stands of all r=1, 2… I-1, and n=1.

The allowance range of perturbations C_i^c is obtained as

$$[\delta_{l-}^C, \delta_{l+}^C]$$

The sensitivity coefficient is obtained as:

$$\frac{1}{\left|\delta_{l-}^C - \delta_{l+}^C\right|}$$

One of the calculation methods for Sensitivity Analysis is to use the "Boost" approach. The Boost approach is a scenario-driven method that the analysis is done around

boosting one factor (at a time) to the maximum and observing the impact of that on the result and other perspectives or criteria's relative importance. More details of this method of sensitivity analysis are provided after the case study analysis alongside the research sensitivity analysis in Chapter six.

Desirability Curves in Hierarchical Decision Model

The concept of desirability curves is applied to calculate the Customer-centricity score. For each of the factors in the model, the desirability of levels is determined by collecting the inputs from the experts. The panel experts assign a desirability value for each of those levels between 0 and 100. The 100 is the most desirable situation, and 0 is the least desired state of that level. Then these desirability values are used to plot the desirability curves.

According to Estep [218], "The purpose of these curves is to identify how "desirable" or "valuable" a metric is for a decision-maker."

For example, let us assume the researcher intends to assign desirability to different levels of a criterion named "data collection robustness." With the expert panels' assistance, the researcher comes up with different states or situations for this criterion and names them Disability levels. Here are the four levels for data collection robustness which experts recommend:

- Level 1: The data collection methods are ineffective and do not provide reliable and usable data
- Level 2: The data collection methods are semi-structured and provide some usable data

- Level 3: The data collection methods are fully structured and provide entirely usable data, which requires data cleaning
- Level 4: The data collection methods provide ready to use data that is comprehensive and reliable

Then for each level, the experts determine how much it is desirable. The average of the experts' input is used to assign the desirability percentage to the levels.

- Level 1: 10%
- Level 2: 20%
- Level 3: 40%
- Level 4: 100%

Moreover finally, the relationship between levels and the desirability values are illustrated in the desirability curve as shown in the example below:

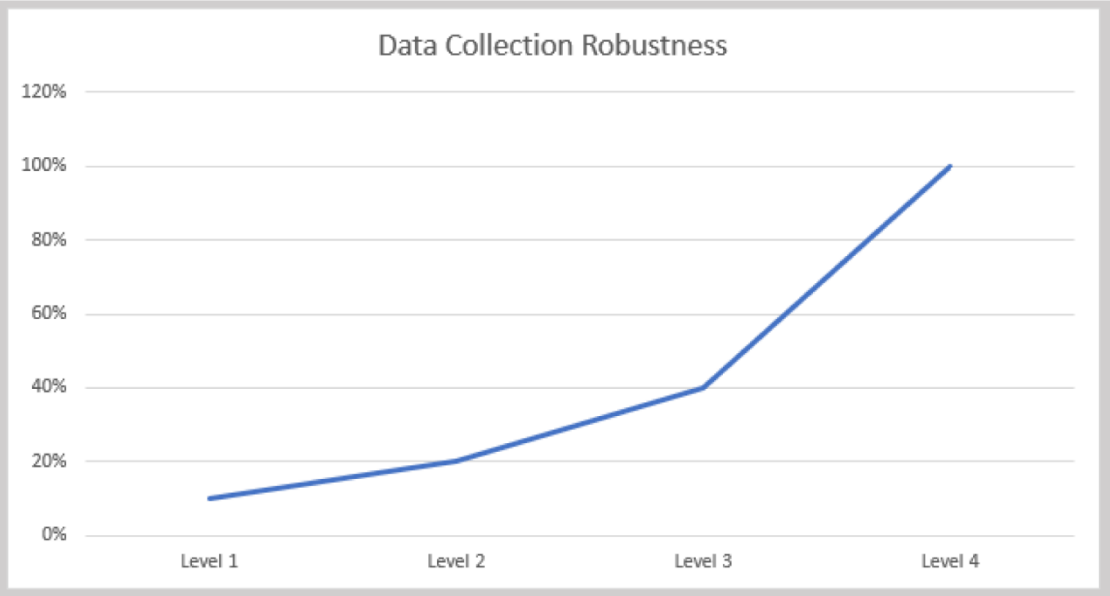


Figure 17: Example Desirability Curve Diagram for Data Collection Robustness

Calculating Customer-centricity Score

One of the research objectives is to develop a decision model resulting in a Customer-centricity score that can be used to assess an organization's maturity level from the customer orientation perspective.

Customer-centricity is a multi-dimensional characteristic of an organization. In other words, multiple factors or criteria accumulatively determine how much an organization is customer-centric. Therefore, evaluation of the customer-centricity of an organization cannot be done unless the customer-centricity is broken down into impacting factors and criteria.

Then the hierarchical decision model along with desirability curves is used to build a re-usable model which:

- Reveals what are the impacting criteria in deciding the level of customer-centricity
- Defines the levels of maturity for each criterion
- Quantifies the customer-centricity through a pair-wise comparison model (HDM)
- Identifies the level of maturity of an organization

- Provides recommendations for improving the customer-centricity through enhancing the areas with lower scores

The customer-centricity score is determined by the sum product of the perspective, criteria weights, and desirability values. The mathematical expression for calculating the customer-centricity score is presented below:

$$S_{CC} = \sum_{i=1}^{m}\sum_{j=1}^{n}(P_j)(C_{i,j})(D_{i,j})$$

Where

S_{CC} is the Customer-centricity Score

P_j is the relative value of perspective j with respect to Customer-centricity Score

$$where\ j = 1,2,\dots,n$$

$C_{i,j}$ is the relative value of criteria i under perspective j with respect to Customer-centricity Score

$$where\ j = 1,2,\dots,n\ \ AND\ i = 1,2,\dots,m$$

$D_{i,j}$ is the Desirability value of criteria i under perspective j

$$where\ j = 1,2,\dots,n\ \ AND\ i = 1,2,\dots,m$$

The Perspective and Criteria weights, as well as Desirability values, are determined by judgment quantifications from the experts. They are used as input to calculate the overall customer-centricity score. In the next section, the expert panel and consideration in the formation of such panels are discussed in detail.

Expert Panel Formation

In this research, literature review and expert feedback are used to identify the most critical factors influencing customer-centricity, focusing on e-commerce and online retail organizations.

In order the quantify and validate the model, multiple expert panels are involved. The expert panel's judgment is crucial in this model, and the effectiveness of the model entirely relies on it. The expert panels are formed by involving individuals in academia and industry with backgrounds and knowledge in this field. The experts quantified each factor's impact concerning the customer-centricity, validate if the criteria deserve to be part of the model, suggest other criteria that are not identified in the initial model, and finally evaluate the entire model considering all the definitions and scores.

The HDM methodology is used to elicit expert judgment to identify the relative importance of those factors. Besides, experts' feedback is used to identify possible statuses an organization might have regarding each factor. The data input is made by SME's. As outlined in the previous section, Experts are involved in validating the initial model and quantifying its components.

Definition of Experts and Panels gives a better understanding of these concepts in HDM; An expert is a person who has the relevant knowledge and experience and whose opinions are esteemed by peers in his or her field [219], [227]. An expert panel is analyzed by [218], who mentioned the [228]: expert panels are groups of individuals with access to current, high-quality information on a related topic.

Since the HDM model is based on experts' judgment and input, selecting the right subject matter expert and forming diverse panels are critical to building a reliable decision model. [219]

Literature suggests considering the following criteria to select the expert panel [229]

- Professional knowledge, background, and experience on the research topic
- Enough availability for participation in panels
- Willingness in participation in the research
- Lack of bias and tendency toward decision alternatives or goal
- Independence in Technical and professional opinion
- Prior experience of working in Committees and expert panels

There is a consensus that the size of the expert panels should be between 6-12 individuals to achieve the expected results [230], [231]. Very large panels could have coordination problems, or very small panels could not be beneficial since experts could think that it is not an obligation to participate [232]

The impact of disagreement on the decision model can be offset by selecting the right expert panel for each level of the decision model. [218]

[229] defines five major steps in forming Expert panels, which is illustrated below:

Figure 18: Five Major Steps in Expert Panel Formation

Validation of the Decision Model

Eight panels of experts are formed to validate and quantify the model. The HDM method requires the researcher to perform validation to enhance the accuracy of the model. Each panel represents certain expertise that is used to evaluate related parts of the model. The primary purpose of validating the model is to confirm all impacting elements are considered and the model structure is close to the real-world experience of the experts.

Multiple validation stages are applied in this research to ensure all elements of the model are valid.

Figure 19: Model Validation Process

“Content validity” is the first measure, and it is used throughout the development of the research model. It refers to the model's ability to properly represent all relevant aspects and elements pertaining to the research topic.

“Construct validity” is utilized after the model is developed to validate the research approach's fitness to past and underlying theories and refers to the ability of the model’s structure to deal with the problem at hand.

The “Perspective and Criteria validation” is the final stage of this process to validate the outcomes of the research and evaluation of the model built with the real world. For perspective and criteria validation, the experts provide feedback regarding the final model as well as recommendations on improving the accuracy of the model.

Research Application and Case Study

In this research, the case study method is performed to demonstrate the application of the model built during this research. The case study also provided another layer of validation and verification for the model in the real world.

To perform a thorough case study, access to information and experts is very critical. One of the reasons for selecting this organization for the case study was the availability of the data to the author and direct access to the experts for SME panel formation.

The quantified model is validated using the case study. The organization's maturity level in the Customer-centricity approach is evaluated and scored, and used as the baseline to enhance its overall customer orientation. During the case study, the criteria, perspective, and desirability with lower scores are identified that is used as the areas for improvement for the organization.

Since the data for perspectives and criteria used in the model are not publicly available to illustrate the performance of the model in real-world and the researcher do not have access to such detailed information in order to demonstrate the proposed model at work, and following case study performed by Phan [217] hypothetical companies in the field of the E-commerce is used to perform the case study. Each hypothetical company is associated with alternative characteristics to differentiate them from one another and illustrate the real situation outcome in a comparative manner.

In other words, these hypothetical companies possess variant strengths and weaknesses in each perspective and criteria, which is modeled in the research. Here is a narrative introduction to these three companies.:

Company A gets high scores regarding technology stacks and data management but lacks specific customer relationship management capabilities. Their communication with the customers is not consistent and takes a long time to respond to any customer support requests.

Company B is a highly structured organization with robust and established processes, and they follow the restricted data privacy policies, but the technologies are obsolete and non-scalable, which negatively impacts the data distribution and accessibility. They invest heavily in customer awareness and training and attempt to acquire more customers through marketing initiatives.

On the other hand, Company C is an agile and flexible start-up in utilizing the new technologies and delivering innovative solutions to the customers. They can customize their solution based on customer needs but do not follow well-structured processes and policies and miss a few of the checkboxes in the privacy and security policies.

During the case study, the perspectives and criteria are quantified for each of these three hypothetical companies. The details of the hypothetical companies are provided later in the research application and case chapter. (Chapter 6)

Chapter Five: Research Design

Research Framework

To perform this research, multiple steps need to be taken. The following flow diagram shows the sequence of the activities for completing this research. Most of the steps are already explained in previous sections, and the rest of the following diagram activities are discussed in the upcoming sections.

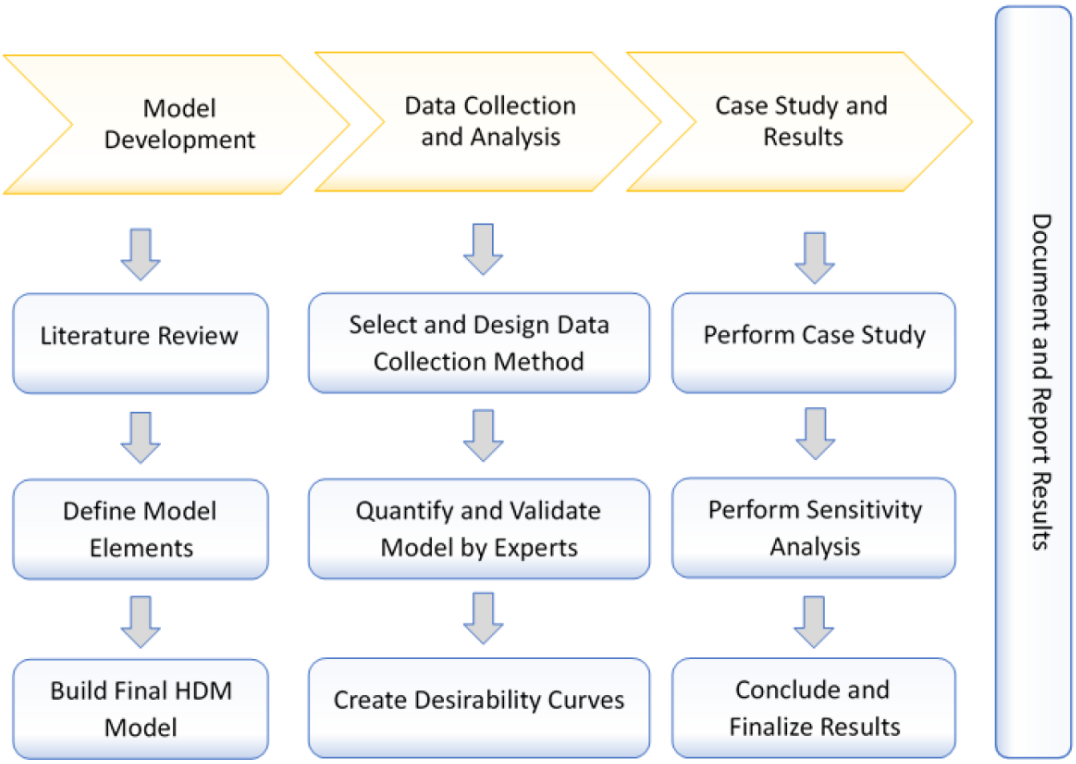


Figure 20: Research Framework

Three main stages are designed for conducting this research. In the first stage, the literature is reviewed thoroughly, and out of the criteria and perspectives, the initial

model is defined. The model is then verified and validated by the expert panel and finalized to be used in the data collection stage. The second stage of this research focuses on collecting related data and analyzing them methodically. First, the data collection tool is selected, customized, and designed for this purpose, and data is collected, respectively. The Expert panels are utilized to quantify and validate the model, and finally, the desirability curve is created. Finally, in the last stage of this research, the proposed model is used to perform a case study and document the results. This model's sensitivity is analyzed and evaluated based on the impacting factors, and research results are concluded and documented in the thesis report. This is the initial framework that may face some updates and enhancement during the research, as necessary.

Hierarchical Decision Model Perspectives

In order to develop the initial HDM model, a thorough literature review is performed, and impacting factors and criteria on customer-centricity are identified. The criteria are categorized into four main perspectives: Technology/Data, Organization, Customer, and Policy.

Each Perspective in the HDM model includes underlying criteria that impact the overall pairwise evaluation model.

Perspective	Description	References
Technology/Data	Technology infrastructure, digital and data capabilities empower the organization to embrace the uncertainty, needs, and flexibility needed for a customer-centric organization. The infrastructure, technology, and data instruments are utilized to deliver, facilitate, or enhance the customer experience in and out of the organization.	[233], [234],[235] [104],[153],[26], [237]–[246],[247]
Organization	This perspective evaluates various aspects of an organization influencing the customer-centricity approach and what needs to be considered on the organizational level to move away from a product-centric approach. This includes	[24], [233], [234], [235], [105],[28], [243], [250]–[260]

	employees, leadership support, strategy, organizational assets, inputs, resources, culture, and capabilities facilitating the transition from product-centricity to customer-centricity	
Customer	This perspective assesses the impact of customer-centric approaches on the customers; The organizations' staff are stakeholders who directly affect customer experience delivery or decision-making regarding customer-centricity approaches. Assessment of customer awareness, satisfaction, and loyalty reveals some of the direct customer-centric initiatives' direct outcomes.	[235], [261], [28], [238], [246], [258]–[260], [262]–[270]
Policy	Organizational accountability regarding the collection, management, and utilization of customer information, impacts customer-centric approach adoption success. The regulatory entities and governing bodies' rules, laws, standard audits, and compliance requirements to protect the stakeholders' assets and rights.	[152],[266], [271]–[274]

Table 8: Perspectives Definitions

Technology/Data Perspective

This perspective focus on technology infrastructure, digital and data capabilities, which empower the organization to embrace the uncertainty, needs, and flexibility needed on customer-centric organization

The category of factors related to infrastructure, technology, and data instruments is utilized to deliver, facilitate, or enhance the customer experience. Here are the definitions of each criterion categorized under Technology/Data Perspective:

Criterion	Details	References
Technology Infrastructure and Integration	Developing the key internal technology platforms for Customer-centricity. Bringing visibility to customer needs as quickly as possible. Enable the organization to track and action the Customer needs	[237], [239]–[242]
Data Distribution and Accessibility	Data easily is accessible by the relevant users, and it is distributed freely in the organization	[30], [243],[244]
Data Collection Robustness	Level of robustness in data collection methods impacted by depth and reliability of the information	[26], [30], [177], [243], [244]
Data Metrics Clarity	Clearly defined metrics and measures for evaluating the needs and requests of the customer	[238], [243]–[245]
Data Analytics Capabilities	Access to insightful and actionable information enabled by advanced analytics	[30], [243], [244], [247]

Table 9: Technology Perspective's Criteria Definition

Customer Perspective

This perspective assesses the impact of customers on the organization; Predominantly focusing on the awareness and

Criterion	Details	References
Awareness and Training	Level of familiarity of Customer with products, services, and organization	[26], [259], [268]
Satisfaction	Level of satisfaction of Customer regarding the products and services	[258], [260], [262], [263], [269], [270], [275]
Expectation	Level of the fulfillment of expectations of customers with the products and services	[177], [238], [263], [269]
Loyalty and commitment	Probability of recurring purchases by customer and referring the products, services, or organization to other prospect customers.	[258], [265], [266], [269],[264]

Table 10: Customer Perspective's Criteria Definition

Organization Perspective

This perspective is about How different aspects of an organization influence the customer-centricity approach and what needs to be considered on the organizational level to move away from a product-centric approach. This includes all corporate assets, inputs, resources, culture, and capabilities facilitating the transition from product centricity to customer-centricity. Here are the definitions of each criterion categorized under Organization Perspective:

Criterion	Details	References
Process robustness	Possession of robust processes mainly on following domains: • Requirement Gathering processes • CX centric Product/Service design • Feedback and response processes • Customer relationship management	[243], [256], [275], [253]–[255]
Organizational Structure	How the organization builds interdisciplinary teams and level of flexibility and adaptability to re-organize and embrace uncertainty	[257], [258]
Cultural Strength	strong, sustainable, scalable organizational culture aligned with customer needs Common definition of customer-centricity Clarity and comprehensive Communication Willingness to change	[257], [259], [275]

Strategy focus	Customer Experience driven product and service roadmaps and Customer Data-driven product and service design	[258], [260]
Staff Expertise	Technical and inter-personal Skillset and the attitude toward change and flexibility in processes	[250], [251], [256]
Leadership Support	Leadership support and sponsorship of change management	[251], [252], [257], [258]

Table 11: Organization Perspective's Criteria Definition

Policy Perspective

In this perspective, organizational accountability in the collection, management, and utilization of customer information impacts an organization's success in customer-centric approach adoption. The perspective focuses on regulatory entities and governing bodies' rules, laws, standard audits, and compliance requirements to protect the stakeholders' assets and rights. Here are the definitions of each criterion categorized under Policy Perspective:

Criterion	Details	References
Data Privacy Compliance	Compliance with local, regional, and global customer information privacy requirements	[271], [273],[272]
Data Security Compliance	Compliance with local, regional, and global customer information Security requirements	[266], [271], [273], [274]
Data Ownership	Level of freedom in the organization for distributing data and analytics collected and generated by the organization	[273], [274]
Data Governance	The management of the availability, usability, integrity of data by the organization	[271], [273]

Table 12: Policy Perspective's Criteria Definition

Initial HDM Model

The perspectives and criteria described in the previous section for a hierarchical model are illustrated in the below figure. This initial model is used for building the Maturity Model and evaluating the Maturity level of an enterprise. In the next section, involving the experts in quantifying these criteria is further explained, and the next steps of this research are outlined. This model was enhanced according to the insightful feedback during the Comprehensive Exam.

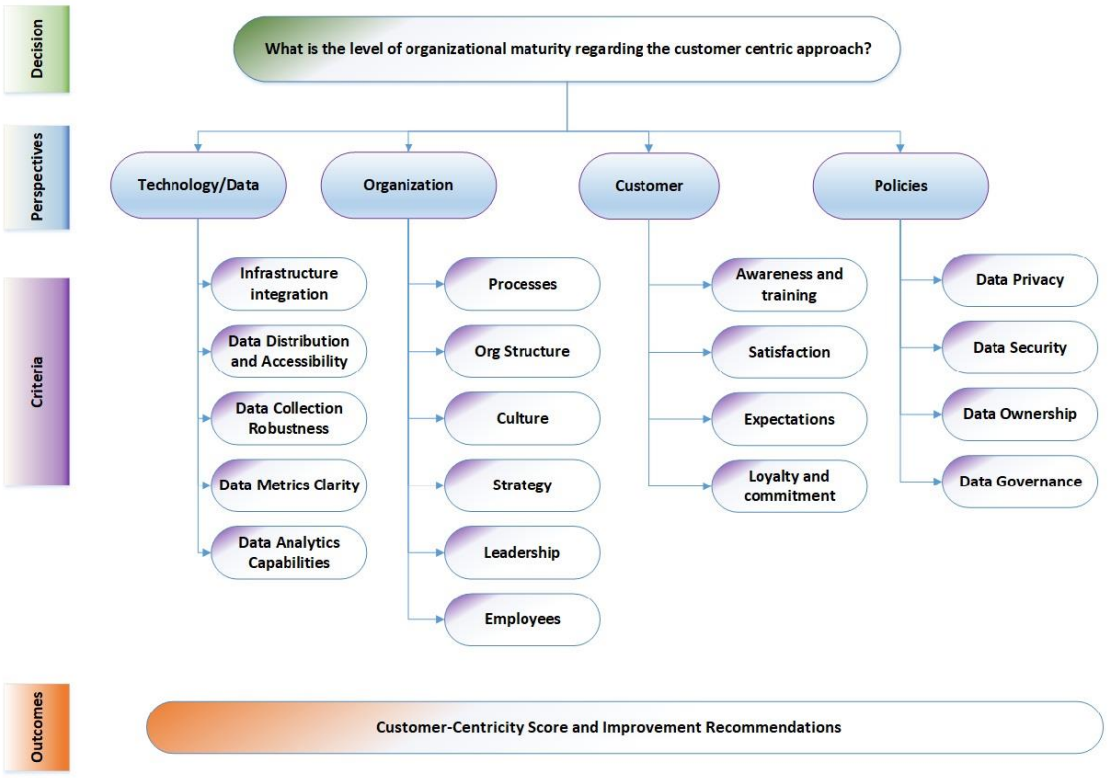


Figure 21: HDM Initial Model

Experts Panel Design

In reference to the discussion about the expert selection in the previous section and previous similar research, in terms of using the HDM methodology ([218][218][220][276][222][217][221]), my research includes eight panels to validate and quantifying my model.

Panel	Role	Tool
P1	Validate Perspectives	Qualtrics survey
P2	Validate Criteria	Qualtrics survey
P3	Quantify Perspectives	ETM HDM software
P4	Quantify Criteria - Technology	ETM HDM software
P5	Quantify Criteria - Organization	ETM HDM software
P6	Quantify Criteria - Customer	ETM HDM software
P7	Quantify Criteria - Policy	ETM HDM software
P8	Quantify Desirability Curves	Qualtrics survey

Table 13: Expert Panel Design

P1: This panel **validates the perspectives** of the model. They are asked through the Qualtrics survey tool to approve the perspectives identified from the literature review and suggest their own perspectives if any other exists. Experts should be coming from a management background or academic background.

P2: This panel **validates the Criteria** of the model. They are asked through the Qualtrics survey tool to approve the criteria identified under the perspectives and

suggest their own perspectives if any other exists. Experts should be coming from a management background or academic background.

P3: This panel is asked to **quantify the perspectives** by conducting pairwise comparisons between every two perspectives, using the HDM methodology via the ETM HDM software. Also, to quantify the related desirability curves using the Qualtrics survey tool. Experts should be coming from technology, engineering, and management background as well as academic backgrounds.

P4: This panel is asked to quantify the criteria under the **Technology/Data perspective** by conducting pairwise comparisons between every two perspectives, using the HDM methodology via the ETM HDM software. Also, to quantify the related desirability curves using the Qualtrics survey tool. Experts should be coming from technology, engineering, and management background as well as academic backgrounds.

P5: This panel is asked to quantify the criteria under the **Organization perspective** by conducting pairwise comparisons between each two perspectives, using the HDM methodology via the ETM HDM software. Also, to quantify the related desirability curves using the Qualtrics survey tool. Experts should be coming from technology, engineering, and management background as well as academic backgrounds.

P6: This panel is asked to quantify the criteria under the **Customer perspective** by conducting pairwise comparisons between every two perspectives, using the HDM methodology via the ETM HDM software. Also, to quantify the related desirability

curves using the Qualtrics survey tool. Experts should be coming from technology, engineering, and management background as well as academic backgrounds.

P7: This panel is asked to quantify the criteria under the **Policy perspective** by conducting pairwise comparisons between each two perspectives using the HDM methodology via the ETM HDM software. Also, to quantify the related desirability curves using the Qualtrics survey tool. Experts should be coming from technology, engineering, and management background as well as academic backgrounds.

P8: This panel **quantifies the maturity levels based on e-commerce** and online retail sector information against the desirability curves through Qualtrics surveys. Experts should be individuals related to the technical and management of online retailers and e-commerce businesses and have a deep understanding of the organization's customer-centricity.

The general selection criteria for experts regarding the assessment of maturity levels of customer-centricity in the e-commerce sector include:

- Expertise in the topic.
- Balance biases.
- Diversity in terms of background, details of exposure to the research topic, and coming, as much as possible, from different organizations to avoid bias by influence.

Furthermore, the research instruments would be the Email, VoIP software (e.g., Hangout and WhatsApp), and online software tools (e.g., HDM and Qualtrics), so

panelists did not meet physically; hence, bias by influence and silent bystanders' issues did not affect research quality.

Data Collection

There are numerous reasons that researchers need to collect and analyze the data from experts and include their judgment in different stages of research, from hypothesis generation and model development to the interpretation of the results and research conclusion. Therefore, research needs to understand and prevent the common issues in forming an expert panel and selecting the experts.

The value and quality of an expert's judgment depend on; how informative the decision is; how close it is to reality; and how certain it is. However, such expert judgment quality can be undermined by several factors, including "bias" and "self-serving. " Mahoney [277]defines bias as a tendency to emphasize and believe experiences which support one's views and to ignore or discredit others.

Another challenge that researchers who work with Expert panels face is the availability and willingness to participate in the research, which can hinder the researcher from collecting all the required opinions and judgments. In addition, in the expert panels, there may be some experts that try to influence the opinions of

other experts if they can directly communicate with each other. Also, there are "silent Bystanders" who would not offer proper judgment in a panel discussion.

In this research, literature review and expert feedback are used to identify the most critical factors influencing customer-centricity, focusing on product-service systems in e-commerce organizations. Then, through HDM methodology, expert judgment was collected to determine the relative importance of those factors. In addition, experts' feedback is used to identify possible statuses an organization might have regarding each factor. The data input is made by SME's. As outlined in the previous section, Experts are involved in validating the initial model and quantifying its components.

The Snowball sampling method [278] is used to identify the experts of each group, and the following criteria are used to select through the list of the available experts:

- Relevant expertise within the research area
- Availability and willingness to participate
- Balanced perspectives and biases

Chapter Six: Results of Model Validation and Quantification

This chapter presents the results of conducting the research steps as outlined in the previous chapters. During the research design step, the initial model was developed according to the literature review findings. The Figure below illustrates the initial hierarchical model of perspectives and criteria which during literature review were identified as impactful on customer-centricity approach in organization

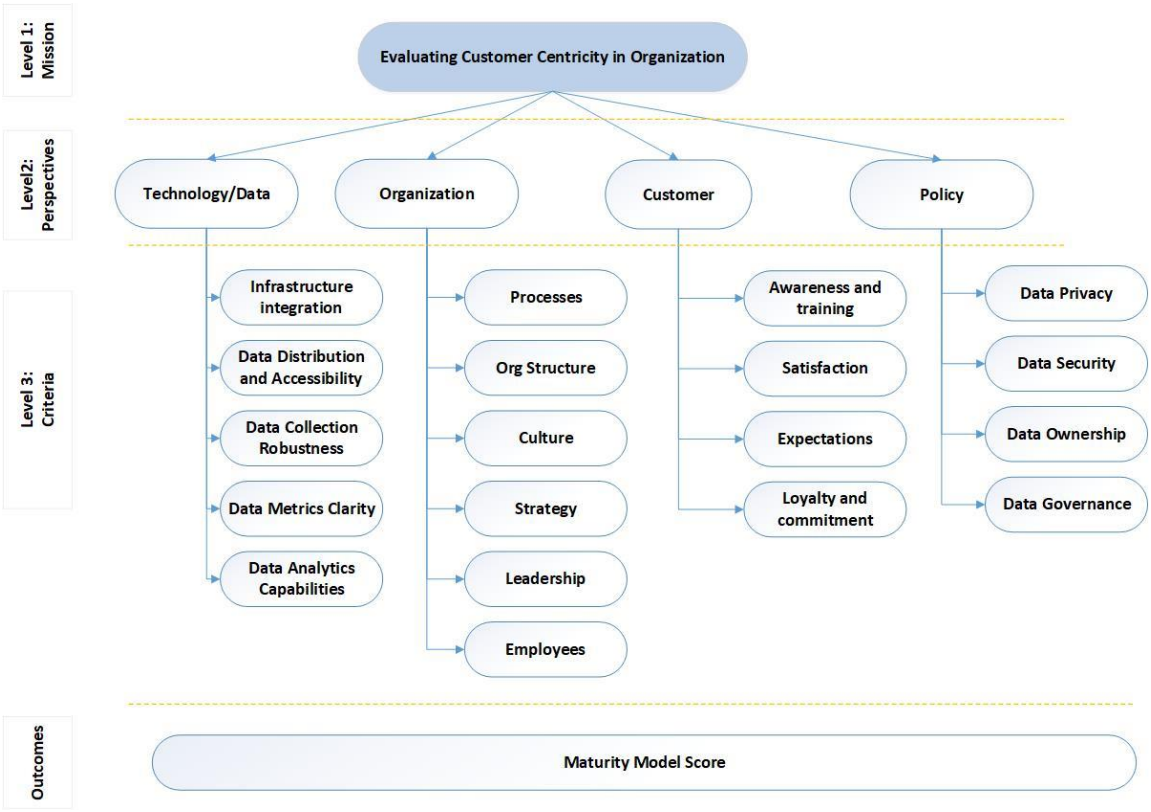


Figure 22: Initial HDM Model

After the literature review, the researcher took three major steps to finalize the design of the HDM model; first, all the perspectives and criteria got validated, and missing factors were identified according to the Subject Matter Experts. Second, the

finalized list of the factors from the first step is quantified, and the relative impact of each factor on the customer-centricity approach is determined through the input collected from the Experts. Finally, the desirability curve levels and values are created based on input from experts

The expert panel formation and data collection are conducted based on details explained in Section below, and this chapter presents the results.

Model Validation

Perspective validation

All perspectives are approved with more than 95% approval rates. The table below summarizes the P1 panel responses and their judgment in regard to the perspectives that impact the customer-centricity in an organizations

Perspective	Total Responses	Yes	No	Validation %
Technology/Data	24	24	0	100.0%
Organization	24	24	0	100.0%
Customer	24	23	1	95.8%
Policy	24	24	0	100.0%

Table 14: Perspective Validation Result

Panel 1	Technology/Data	Organization	Customer	Policy
Expert #1	Yes	Yes	Yes	Yes

Expert #2	Yes	Yes	Yes	Yes
Expert #3	Yes	Yes	Yes	Yes
Expert #4	Yes	Yes	Yes	Yes
Expert #5	Yes	Yes	Yes	Yes
Expert #6	Yes	Yes	Yes	Yes
Expert #7	Yes	Yes	Yes	Yes
Expert #8	Yes	Yes	Yes	Yes
Expert #9	Yes	Yes	Yes	Yes
Expert #10	Yes	Yes	Yes	Yes
Expert #11	Yes	Yes	Yes	Yes
Expert #12	Yes	Yes	Yes	Yes
Expert #13	Yes	Yes	Yes	Yes
Expert #14	Yes	Yes	Yes	Yes
Expert #15	Yes	Yes	Yes	Yes
Expert #16	Yes	Yes	No	Yes
Expert #17	Yes	Yes	Yes	Yes
Expert #18	Yes	Yes	Yes	Yes
Expert #19	Yes	Yes	Yes	Yes
Expert #20	Yes	Yes	Yes	Yes
Expert #21	Yes	Yes	Yes	Yes
Expert #22	Yes	Yes	Yes	Yes
Expert #23	Yes	Yes	Yes	Yes
Expert #24	Yes	Yes	Yes	Yes

Table 15: Perspective Validation Responses

Criteria Validation – Technology/Data

All criteria under the Technology/Data perspective are approved with an over 91% approval rate. The table below summarizes the P2 panel responses and their judgment in regards to the Criteria under Technology/Data that impact the customer-centricity in organizations.

Criteria	Total Responses	Yes	No	Validation %
Technology Infrastructure and Integration	24	22	2	91.7%
Data Distribution and Accessibility	24	23	1	95.8%
Data Collection Robustness	24	22	2	91.7%
Data Metrics Clarity	24	23	1	95.8%
Data Analytics Capabilities	24	23	1	95.8%

Table 16: Criteria Validation Result – Technology

Expert Number	Technology Infrastructure and Integration	Data Distribution and Accessibility	Data Collection Robustness	Data Metrics Clarity	Data Analytics Capabilities
Expert #1	Yes	Yes	Yes	Yes	Yes
Expert #2	Yes	Yes	Yes	Yes	Yes
Expert #3	Yes	Yes	Yes	Yes	Yes

Expert #4	Yes	Yes	Yes	Yes	Yes
Expert #5	Yes	Yes	Yes	Yes	Yes
Expert #6	Yes	Yes	Yes	Yes	Yes
Expert #7	Yes	Yes	Yes	Yes	Yes
Expert #8	Yes	Yes	Yes	Yes	Yes
Expert #9	Yes	Yes	Yes	Yes	Yes
Expert #10	No	Yes	No	Yes	Yes
Expert #11	No	Yes	Yes	Yes	Yes
Expert #12	Yes	Yes	Yes	Yes	Yes
Expert #13	Yes	Yes	Yes	Yes	Yes
Expert #14	Yes	Yes	Yes	Yes	Yes
Expert #15	Yes	Yes	Yes	Yes	Yes
Expert #16	Yes	Yes	Yes	Yes	Yes
Expert #17	Yes	Yes	Yes	Yes	Yes
Expert #18	Yes	No	No	No	No
Expert #19	Yes	Yes	Yes	Yes	Yes
Expert #20	Yes	Yes	Yes	Yes	Yes
Expert #21	Yes	Yes	Yes	Yes	Yes
Expert #22	Yes	Yes	Yes	Yes	Yes
Expert #23	Yes	Yes	Yes	Yes	Yes
Expert #24	Yes	Yes	Yes	Yes	Yes

Table 17: Criteria Validation Responses - Technology

Criteria Validation – Organization

All criteria under the Organization perspective are approved with over 75% approval rate. The table below summarizes the P2 panel responses and their judgment in regard to the Criteria under Organization that impact the customer-centricity in an organization. The finance criterion was added after some experts on Panel P1 pointed out the importance of considering the financial aspects of the organization.

The initial suggestion was to add finance as a high-level perspective. However, after discussing this factor with the experts, the researcher found out it is just other criteria under the Organization factor. Therefore, in the data collection from Panel P2, the finance criterion was added to this perspective.

Criteria	Total Responses	Yes	No	Validation %
Process robustness	24	24	0	100.0%
Organizational Structure	24	24	0	100.0%
Cultural Strength	24	23	1	95.8%
Strategy focus	24	22	2	91.7%
Staff Expertise	24	20	4	83.3%
Leadership Support	24	24	0	100.0%
Financials	24	18	6	75.0%

Table 18: Criteria Validation Result – Organization

Expert Number	Process robustness	Organizational Structure	Cultural Strength	Strategy focus	Staff Expertise	Leadership Support	Financials
Expert #1	Yes	Yes	Yes	Yes	No	Yes	No
Expert #2	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Expert #3	Yes	Yes	Yes	Yes	No	Yes	No
Expert #4	Yes	Yes	Yes	Yes	No	Yes	Yes
Expert #5	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Expert #6	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Expert #7	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Expert #8	Yes	Yes	Yes	Yes	Yes	Yes	No
Expert #9	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Expert #10	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Expert #11	Yes	Yes	Yes	No	No	Yes	Yes
Expert #12	Yes	Yes	Yes	Yes	Yes	Yes	No
Expert #13	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Expert #14	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Expert #15	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Expert #16	Yes	Yes	Yes	Yes	Yes	Yes	No
Expert #17	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Expert #18	Yes	Yes	Yes	No	Yes	Yes	Yes
Expert #19	Yes	Yes	No	Yes	Yes	Yes	No

Expert #20	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Expert #21	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Expert #22	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Expert #23	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Expert #24	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Table 19: Criteria Validation Responses - Organization

Criteria Validation – Customer

All criteria under the Customer perspective are approved with an over 91% approval rate. The table below summarizes the P2 panel responses and their judgment in regard to the Criteria under customer that impact the customer-centricity in an organization.

Criteria	Total Responses	Yes	No	Validation %
Awareness and Training	24	24	0	100.0%
Satisfaction	24	23	1	95.8%
Expectation	24	23	1	95.8%
Loyalty and commitment	24	22	2	91.7%

Table 20: Criteria Validation Result - Customer

Expert Number	Awareness and Training	Satisfaction	Expectation	Loyalty and commitment
Expert #1	Yes	No	No	No
Expert #2	Yes	Yes	Yes	Yes
Expert #3	Yes	Yes	Yes	Yes
Expert #4	Yes	Yes	Yes	Yes
Expert #5	Yes	Yes	Yes	Yes
Expert #6	Yes	Yes	Yes	Yes
Expert #7	Yes	Yes	Yes	Yes
Expert #8	Yes	Yes	Yes	Yes
Expert #9	Yes	Yes	Yes	Yes
Expert #10	Yes	Yes	Yes	Yes

Expert #11	Yes	Yes	Yes	Yes
Expert #12	Yes	Yes	Yes	Yes
Expert #13	Yes	Yes	Yes	Yes
Expert #14	Yes	Yes	Yes	Yes
Expert #15	Yes	Yes	Yes	Yes
Expert #16	Yes	Yes	Yes	Yes
Expert #17	Yes	Yes	Yes	Yes
Expert #18	Yes	Yes	Yes	Yes
Expert #19	Yes	Yes	Yes	Yes
Expert #20	Yes	Yes	Yes	Yes
Expert #21	Yes	Yes	Yes	Yes
Expert #22	Yes	Yes	Yes	No
Expert #23	Yes	Yes	Yes	Yes
Expert #24	Yes	Yes	Yes	Yes

Table 21: Criteria Validation Responses - Customer

Criteria Validation – Policy

All criteria under the Policy perspective are approved with an over 91% approval rate. The table below summarizes the P2 panel responses and their judgment in regards to the Criteria under Policy that impact the customer-centricity in an organization.

Criteria	Total Responses	Yes	No	Validation %
Data Privacy Compliance	24	23	1	95.8%
Data Security Compliance	24	21	3	87.5%
Data Ownership	24	20	4	83.3%
Data Governance	24	21	3	87.5%

Table 22: Criteria Validation Result - Policy

Expert Number	Data Privacy Compliance	Data Security Compliance	Data Ownership	Data Governance
Expert #1	No	No	No	No
Expert #2	Yes	Yes	Yes	Yes
Expert #3	Yes	Yes	Yes	Yes
Expert #4	Yes	Yes	Yes	Yes
Expert #5	Yes	Yes	Yes	Yes
Expert #6	Yes	Yes	Yes	Yes
Expert #7	Yes	Yes	Yes	Yes
Expert #8	Yes	Yes	Yes	Yes
Expert #9	Yes	Yes	Yes	Yes
Expert #10	Yes	No	Yes	Yes

Expert #11	Yes	Yes	No	No
Expert #12	Yes	Yes	Yes	Yes
Expert #13	Yes	Yes	Yes	Yes
Expert #14	Yes	Yes	Yes	Yes
Expert #15	Yes	Yes	Yes	Yes
Expert #16	Yes	Yes	Yes	Yes
Expert #17	Yes	Yes	Yes	Yes
Expert #18	Yes	No	No	No
Expert #19	Yes	Yes	Yes	Yes
Expert #20	Yes	Yes	Yes	Yes
Expert #21	Yes	Yes	No	Yes
Expert #22	Yes	Yes	Yes	Yes
Expert #23	Yes	Yes	Yes	Yes
Expert #24	Yes	Yes	Yes	Yes

Table 23: Criteria Validation Responses - Policy

Changes to the initial model

All perspectives and criteria were approved by experts with high validation rates. One new criterion was added to the initial HDM model. The finance criterion was added after some experts on Panel P1 pointed out the importance of considering the financial aspects of the organization.

The initial recommendation from experts was to add finance as a high-level perspective. However, after discussing this factor with the experts, the researcher

found out it is just other criteria under the Organization factor. Therefore, in the data collection from Panel P2, the finance criterion was added to this perspective.

Final HDM Model

The figure below illustrates the final HDM model that is used to evaluate the customer-centricity approach of an organization.

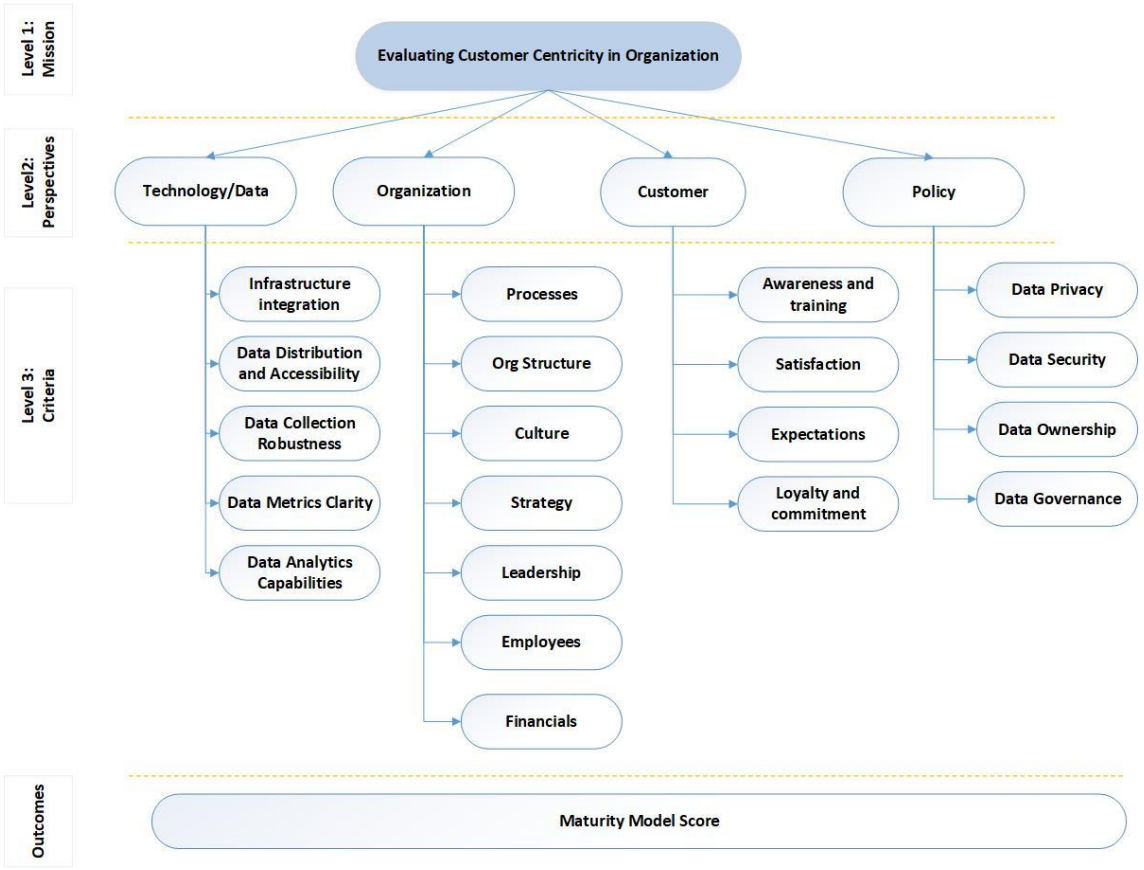


Figure 23: Final HDM Model

HDM Model Quantification

After validation of the factors (Perspectives and Criteria), the researcher involved the experts in the quantification of the factors. Panels P3 through P8 were formed for this

purpose, and experts on each panel were selected based on expertise, knowledge, professional experience, and background.

The quantification of the model was performed through pairwise comparison of the factors as outlined in the HDM methodology. For this purpose, ETM HDM software was used to collect the data from experts.

The following sections represent the HDM model quantification results which are derived from expert judgments.

Perspective Quantification

The relative importance of the perspectives is determined by pairwise comparison of these factors.

The table below presents the results, and the figure below illustrates the average weight of each factor based on experts' judgments.

P3 Panel	Technology/ Data	Organization	Customer	Policy	Inconsistency
Expert #3	0.17	0.45	0.28	0.1	0.02
Expert #15	0.21	0.38	0.3	0.1	0.06
Expert #9	0.23	0.27	0.27	0.22	0
Expert #7	0.18	0.24	0.38	0.2	0
Expert #4	0.2	0.3	0.37	0.13	0.03
Expert #12	0.18	0.45	0.27	0.1	0.02
Expert #11	0.16	0.09	0.22	0.53	0.03
Expert #19	0.19	0.29	0.4	0.12	0.04
Expert #25	0.22	0.22	0.45	0.11	0.02
Mean	0.19	0.3	0.33	0.18	
Minimum	0.16	0.09	0.22	0.1	
Maximum	0.23	0.45	0.45	0.53	
Std. Deviation	0.02	0.11	0.07	0.13	
Disagreement					0.077

Table 24: Perspectives Quantification

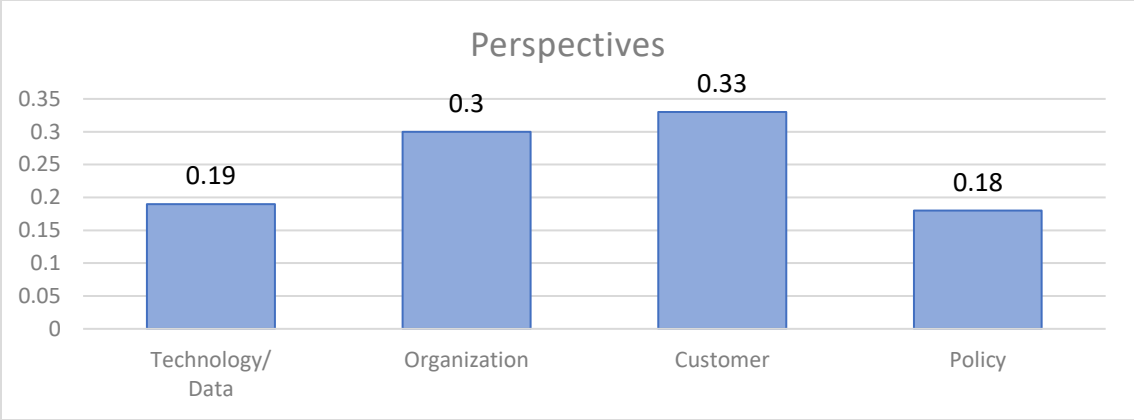


Figure 24: Perspectives Weight

Criteria Quantification – Technology/Data

The relative importance of the criteria under the Technology/Data perspective is determined by pairwise comparison of these factors. The table below presents the results, and the figure below illustrates the average weight of each factor based on experts' judgments.

P4 Panel	Technology Infrastructure and Integration	Data Distribution and Accessibility	Data Collection Robustness	Data Metrics Clarity	Data Analytics Capabilities	Inconsistency
Expert #22	0.51	0.09	0.05	0.19	0.16	0.05
Expert #20	0.24	0.11	0.14	0.18	0.34	0.03
Expert #26	0.24	0.32	0.12	0.13	0.19	0.02
Expert #27	0.12	0.24	0.16	0.11	0.37	0.03
Expert #28	0.2	0.25	0.15	0.16	0.24	0.09
Expert #16	0.31	0.18	0.17	0.1	0.23	0.03
Expert #23	0.29	0.24	0.21	0.13	0.14	0.01
Mean	**0.27**	**0.2**	**0.14**	**0.14**	**0.24**	
Minimum	**0.12**	**0.09**	**0.05**	**0.1**	**0.14**	
Maximum	**0.51**	**0.32**	**0.21**	**0.19**	**0.37**	
Std. Deviation	**0.11**	**0.08**	**0.05**	**0.03**	**0.08**	
Disagreement						**0.068**

Table 25: Criteria Quantification Result - Technology/Data

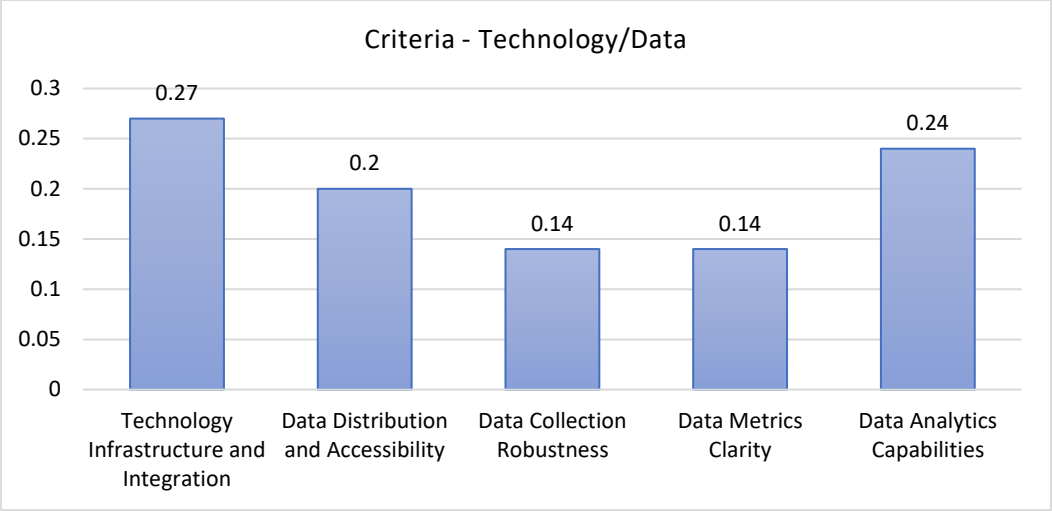


Figure 25: Criteria Weight - Technology/Data

Criteria Quantification – Organization

The relative importance of the criteria under the Organization perspective is determined by pairwise comparison of these factors. The table below presents the results, and the figure below illustrates the average weight of each factor based on experts' judgments.

P5 Panel	Process robustness	Organizational Structure	Cultural Strength	Strategy focus	Staff Expertise	Leadership Support	Financials	Inconsistency
Expert #3	0.07	0.08	0.22	0.16	0.08	0.22	0.17	0.07
Expert #15	0.12	0.09	0.1	0.18	0.23	0.23	0.06	0.08
Expert #9	0.12	0.16	0.12	0.15	0.15	0.14	0.17	0
Expert #7	0.14	0.12	0.15	0.22	0.1	0.18	0.09	0
Expert #4	0.11	0.08	0.24	0.1	0.11	0.25	0.11	0.09
Expert #12	0.13	0.06	0.27	0.11	0.18	0.2	0.06	0.07
Expert #11	0.09	0.13	0.26	0.16	0.11	0.2	0.07	0.04
Expert #25	0.06	0.09	0.09	0.13	0.17	0.17	0.28	0.04
Mean	**0.11**	**0.1**	**0.18**	**0.15**	**0.14**	**0.2**	**0.13**	
Minimum	**0.06**	**0.06**	**0.09**	**0.1**	**0.08**	**0.14**	**0.06**	
Maximum	**0.14**	**0.16**	**0.27**	**0.22**	**0.23**	**0.25**	**0.28**	
Std. Deviation	**0.03**	**0.03**	**0.07**	**0.04**	**0.05**	**0.03**	**0.07**	
Disagreement								**0.047**

Table 26: Criteria Quantification Results - Organization

Figure 26: Criteria Weight - Organization

Criteria Quantification – Customer

The relative importance of the criteria under the Customer perspective is determined by pairwise comparison of these factors. The table below presents the results, and the figure below illustrates the average weight of each factor based on experts' judgments.

P6 Panel	Awareness and Training	Satisfaction	Expectation	Loyalty and commitment	Inconsistency
Expert #3	0.17	0.45	0.12	0.26	0.06
Expert #15	0.06	0.38	0.38	0.18	0.03
Expert #5	0.18	0.45	0.25	0.12	0.01
Expert #8	0.21	0.36	0.16	0.26	0.01
Expert #4	0.14	0.37	0.29	0.21	0.02
Expert #12	0.22	0.06	0.64	0.08	0.01
Mean	**0.16**	**0.35**	**0.31**	**0.19**	
Minimum	**0.06**	**0.06**	**0.12**	**0.08**	
Maximum	**0.22**	**0.45**	**0.64**	**0.26**	
Std. Deviation	**0.05**	**0.13**	**0.17**	**0.07**	
Disagreement					**0.097**

Table 27: Criteria Quantification Results - Customer

Figure 27: Criteria Weight - Customer

Criteria Quantification – Policy

The relative importance of the criteria under the Policy perspective is determined by a pairwise comparison of these factors. The table below presents the results, and the figure below illustrates the average weight of each factor based on experts' judgments.

P7 Panel	Data Privacy Compliance	Data Security Compliance	Data Ownership	Data Governance	Inconsistency
Expert #22	0.25	0.25	0.25	0.25	0
Expert #20	0.25	0.25	0.25	0.25	0
Expert #26	0.3	0.39	0.13	0.19	0.01
Expert #27	0.3	0.37	0.14	0.19	0.02
Expert #28	0.38	0.2	0.15	0.27	0.02
Expert #16	0.28	0.46	0.11	0.15	0.03
Expert #23	0.26	0.3	0.24	0.2	0
Mean	**0.29**	**0.32**	**0.18**	**0.21**	
Minimum	**0.25**	**0.2**	**0.11**	**0.15**	
Maximum	**0.38**	**0.46**	**0.25**	**0.27**	
Std. Deviation	**0.04**	**0.09**	**0.06**	**0.04**	
Disagreement					**0.056**

Table 28: Criteria Quantification Results - Policy

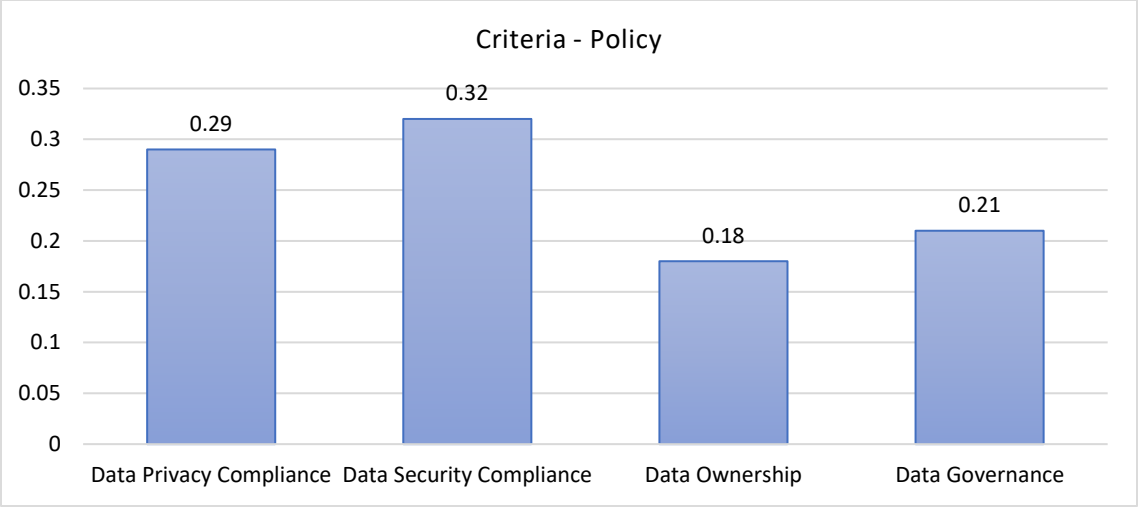


Figure 28: Criteria Weight - Policy

Final Model Weights

The below table illustrates the final weights of the model, which is calculated based on local perspective weight multiplied by the local weight of each criterion under that perspective. The figure below illustrates the impact of each factor on the final outcome of the model.

Perspective	Local Weight	Criteria	Local Weight	Global Weight
Technology/ Data	19.0%	Technology Infrastructure and Integration	27.0%	5.1%
Technology/ Data	19.0%	Data Distribution and Accessibility	20.0%	3.8%
Technology/ Data	19.0%	Data Collection Robustness	14.0%	2.7%
Technology/ Data	19.0%	Data Metrics Clarity	14.0%	2.7%
Technology/ Data	19.0%	Data Analytics Capabilities	24.0%	4.6%
Organization	27.0%	Process robustness	11.0%	3.0%
Organization	27.0%	Organizational Structure	10.0%	2.7%
Organization	27.0%	Cultural Strength	18.0%	4.9%
Organization	27.0%	Strategy focus	15.0%	4.1%
Organization	27.0%	Staff Expertise	14.0%	3.8%

Organization	27.0%	Leadership Support	20.0%	5.4%
Organization	27.0%	Financials	13.0%	3.5%
Customer	33.0%	Awareness and Training	16.0%	5.3%
Customer	33.0%	Satisfaction	35.0%	11.6%
Customer	33.0%	Expectation	31.0%	10.2%
Customer	33.0%	Loyalty and commitment	19.0%	6.3%
Policy	18.0%	Data Privacy Compliance	29.0%	5.2%
Policy	18.0%	Data Security Compliance	32.0%	5.8%
Policy	18.0%	Data Ownership	18.0%	3.2%
Policy	18.0%	Data Governance	21.0%	3.8%

Table 29: Local and Global Weights of HDM model

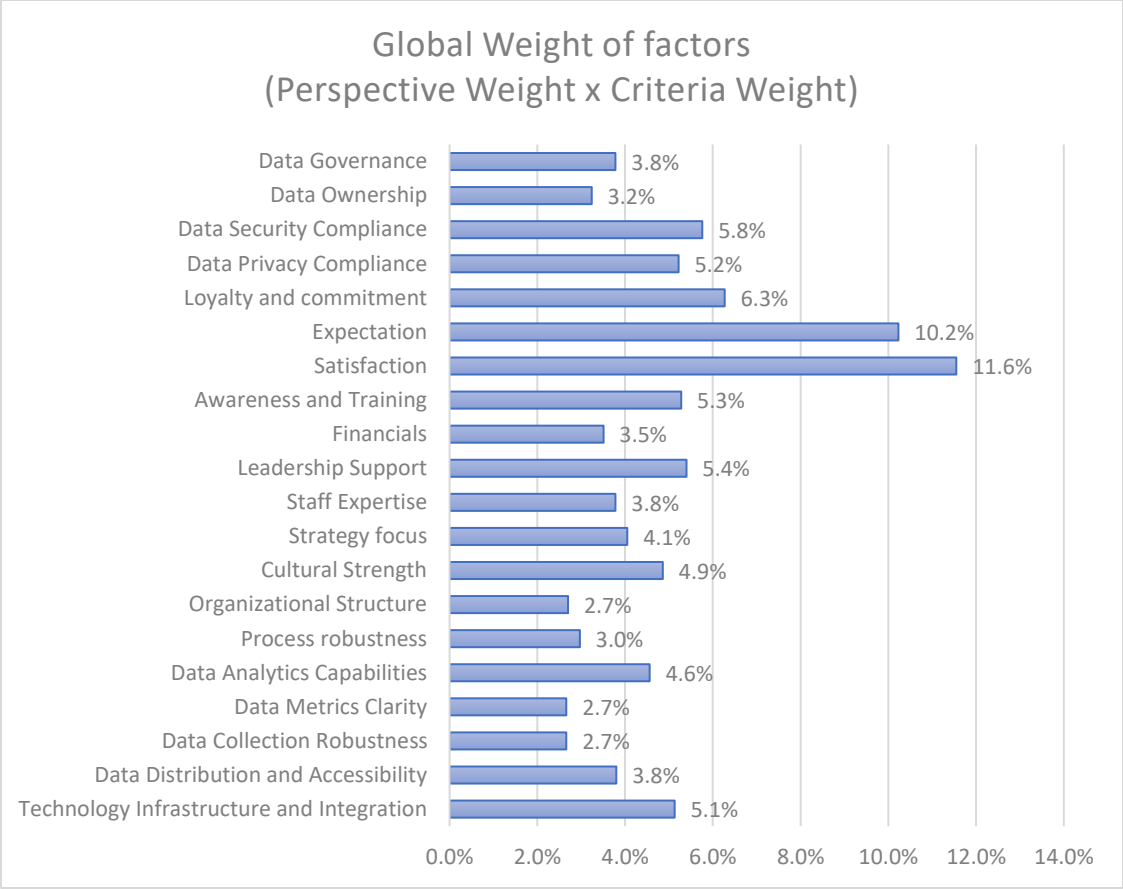


Figure 29: Global Weight of factors

Inconsistency and Disagreement Analysis

The Inconsistency and Disagreement analysis enables the researcher to evaluate the validation of the input collected from the subject matter experts in the HDM model. Since in this methodology, the experts' judgment is one of the major pillars of model development, the reliability of the data that is collected through panels needs to be assessed via Inconsistency and Disagreement analysis.

The mathematical calculation of the Inconsistency is discussed in chapter four. After data collection from the experts, the inconsistency is assessed against the 10% threshold, and any inconsistency above this value requires the researcher to take further action. The two main action items recommended in the HDM model is the evaluation of the expertise of the SME and making sure that they are actually expert in this field or having a discussion with the expert and pointing out the inconsistency in their input and asking them to correct or resubmit their input.

In this research above two actions were taken, and as illustrated in the quantification sections, none of the judgments have major inconsistency (>10%).

The mathematical calculation of the disagreement between experts is discussed in detail in chapter four. After data collection, no major disagreement between experts (>10%) was observed in this research.

Desirability Curves

The Final panel of experts was formed to find the values for the Desirability Curves. The following tables show the different levels that are defined for the desirability curves based on literature review and consultation with experts. Then the experts are asked to value each level based on their experience and judgment.

The below section illustrates the results of desirability curves based on input from experts

Technology Perspective

Technology Infrastructure and Integration

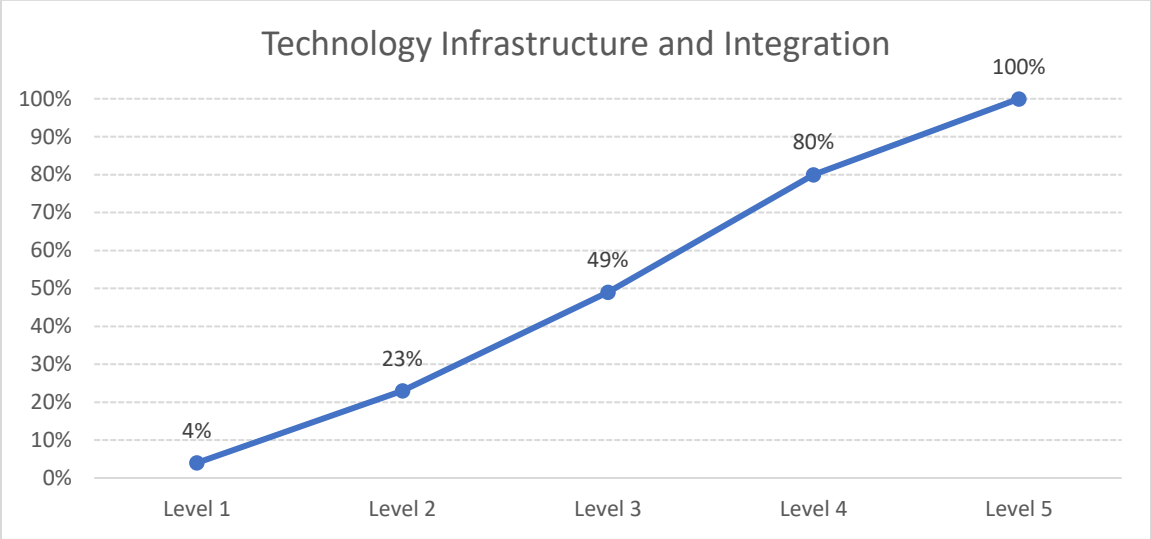


Figure 30: Technology Infrastructure and Integration Desirability Curve

Level	Description	Desirability
Level 1	No Infrastructure or Integration	4%
Level 2	Minimum level of integration	23%
Level 3	Moderate level of integration	49%
Level 4	High level of integration	80%
Level 5	Fully integrated infrastructure	100%

Table 30: Technology Infrastructure and Integration Desirability Curve

Data Distribution and Accessibility

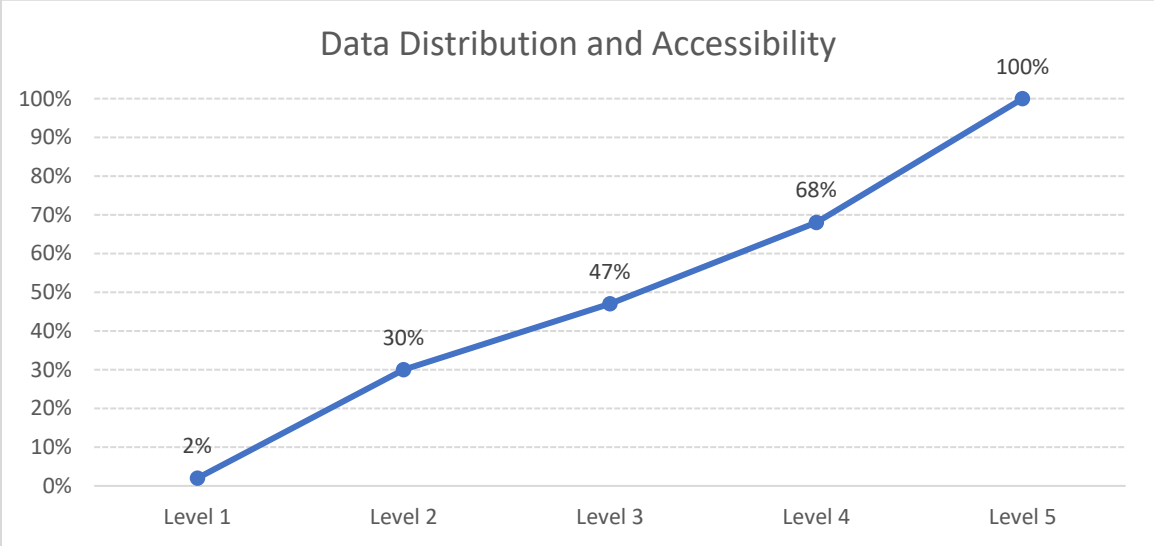


Figure 31: Data Distribution and Accessibility Desirability Curve

Level	Description	Desirability
Level 1	Required data is not available at all	2%
Level 2	30% of required data is accessible when and where needed within an organization	30%
Level 3	50% of required data is accessible when and where needed within an organization	47%
Level 4	70% of required data is accessible when and where needed within an organization	68%
Level 5	Required data is always accessible when and where needed within an organization	100%

Table 31: Data Distribution and Accessibility Desirability Curve

Data Collection Robustness

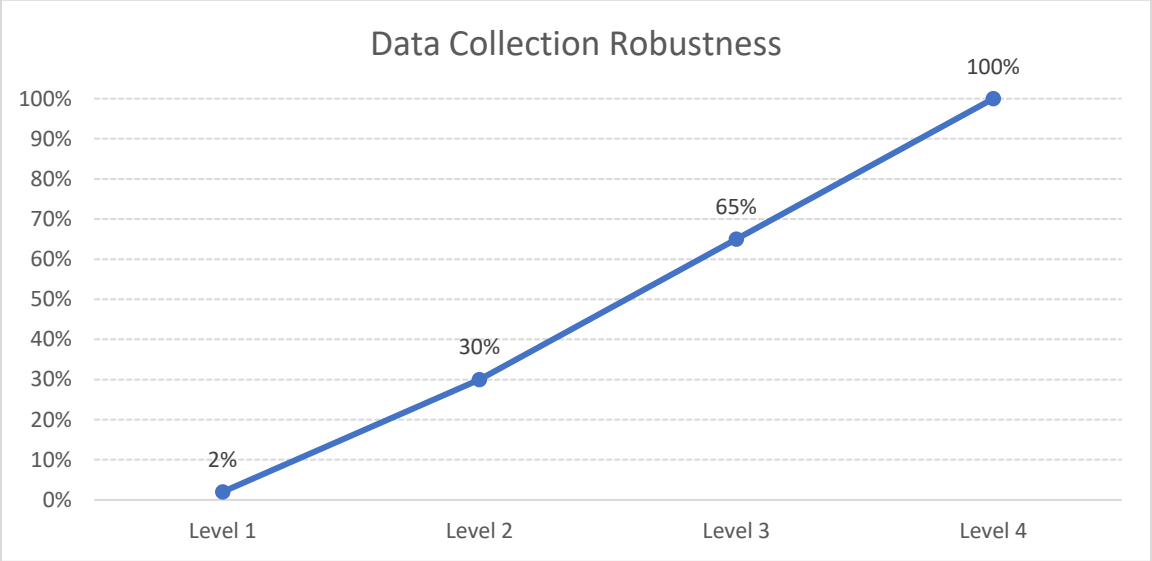


Figure 32: Data Collection Robustness Desirability Curve

Level	Description	Desirability
Level 1	The data collection methods are ineffective and don't provide reliable and usable data	2%
Level 2	The data collection methods are semi-structured and provide some usable data	30%
Level 3	The data collection methods are fully structured and provide fully usable data, which requires data cleaning	65%
Level 4	The data collection methods provide ready to use data that is comprehensive and reliable	100%

Table 32: Data Collection Robustness Desirability Curve Values

Data Metrics Clarity

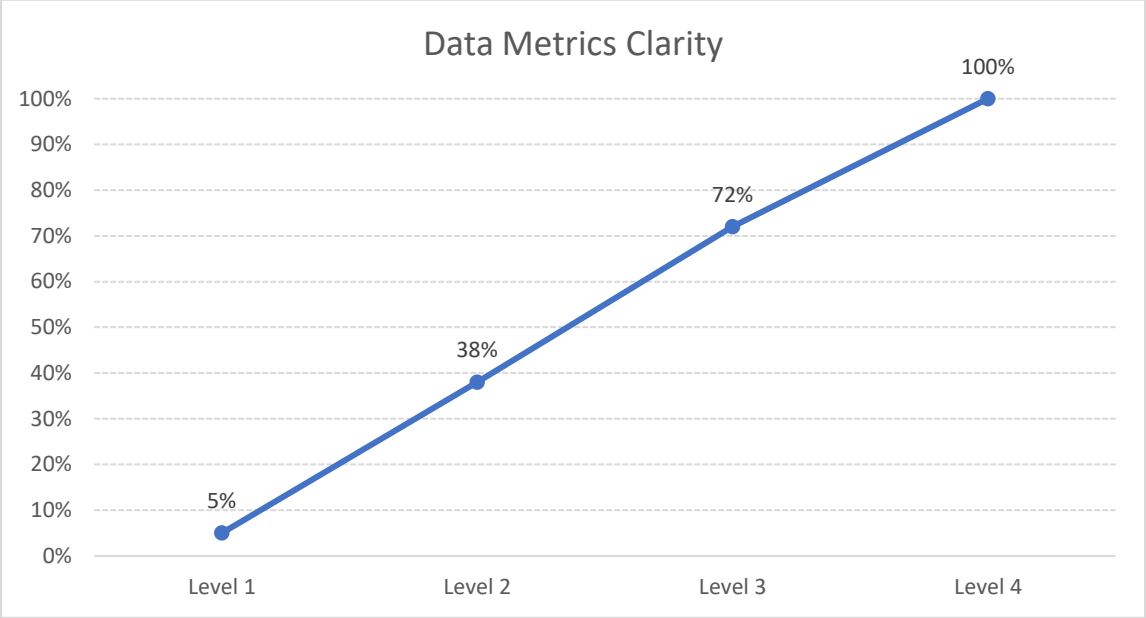


Figure 33: Data Metrics Clarity Desirability Curve

Level	Description	Desirability
Level 1	The data metrics definitions are ineffective and don't provide reliable and useful data	5%
Level 2	The data metrics definitions are semi-organized and provide some useful data	38%
Level 3	The data metrics definitions are fully organized and provide fully usable data, which requires some elaboration	72%
Level 4	The data metrics definitions provide absolute clarity for the data metrics that is comprehensive and reliable	100%

Table 33: Data Metrics Clarity Desirability Curve Values

Data Analytics Capabilities

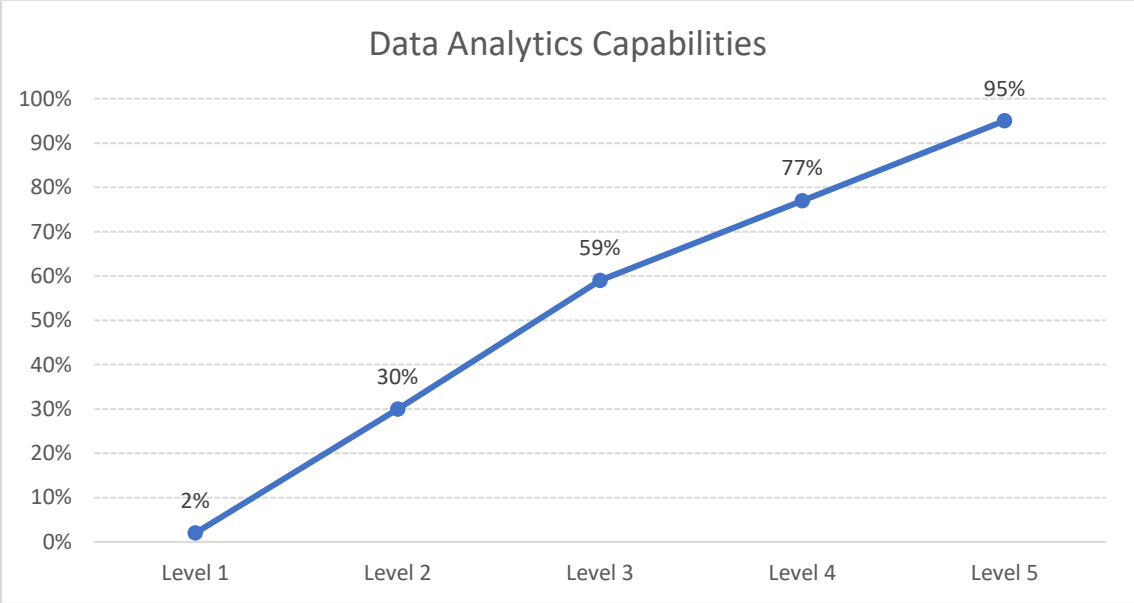


Figure 34: Data Analytics Capabilities Desirability Curve

Level	Description	Desirability
Level 1	Available data is not used for analytical purposes	2%
Level 2	Few departments use data analytics for limited operational decision making	30%
Level 3	Most of the operational activities are driven by data analytics	59%
Level 4	Most of the operational activities and some of the strategic decisions are driven by data analytics	77%
Level 5	All operational and strategic activities of the organization are data-driven	95%

Table 34: Data Analytics Capabilities Desirability Curve Values

Organization Perspective

Process Robustness

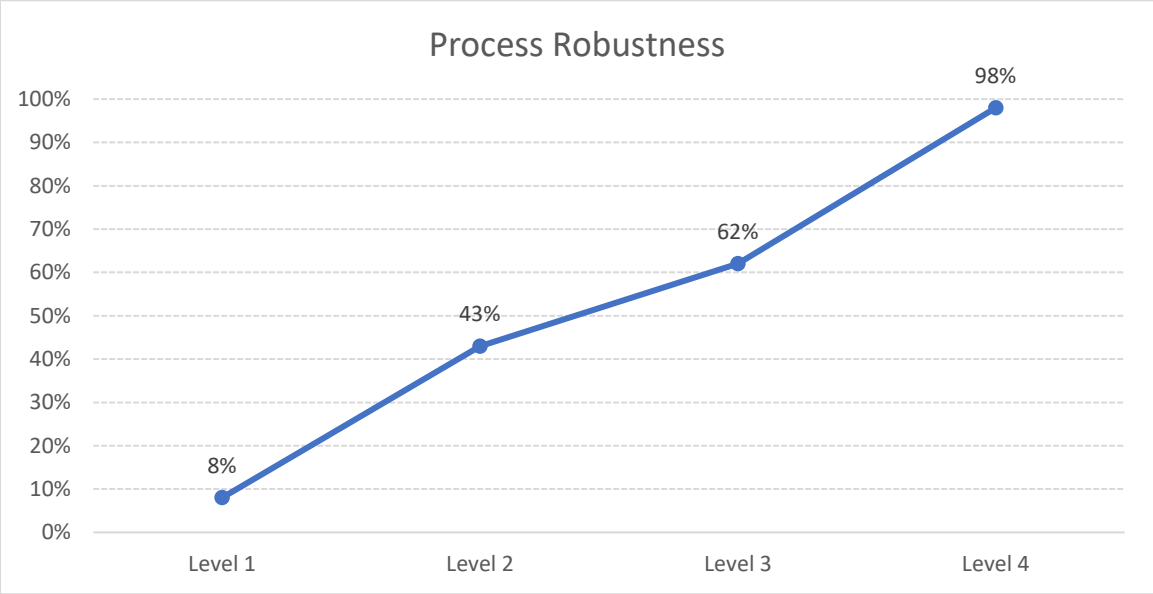


Figure 35: Process Robustness Desirability Curve

Level	Description	Desirability
Level 1	The processes are based on efficient product/service design, and the voice of the customer is not heard in internal teams.	8%
Level 2	The processes are developed based on efficient product/service design with some flexibility to adjust customer needs	43%
Level 3	The processes are developed based on initial customer needs but are not flexible enough to fulfill new customer needs in the shortest time	62%
Level 4	The processes are developed based on customer needs and are flexible enough to fulfill new customer needs in the shortest time	98%

Table 35: Process Robustness Desirability Curve Values

Organizational Structure

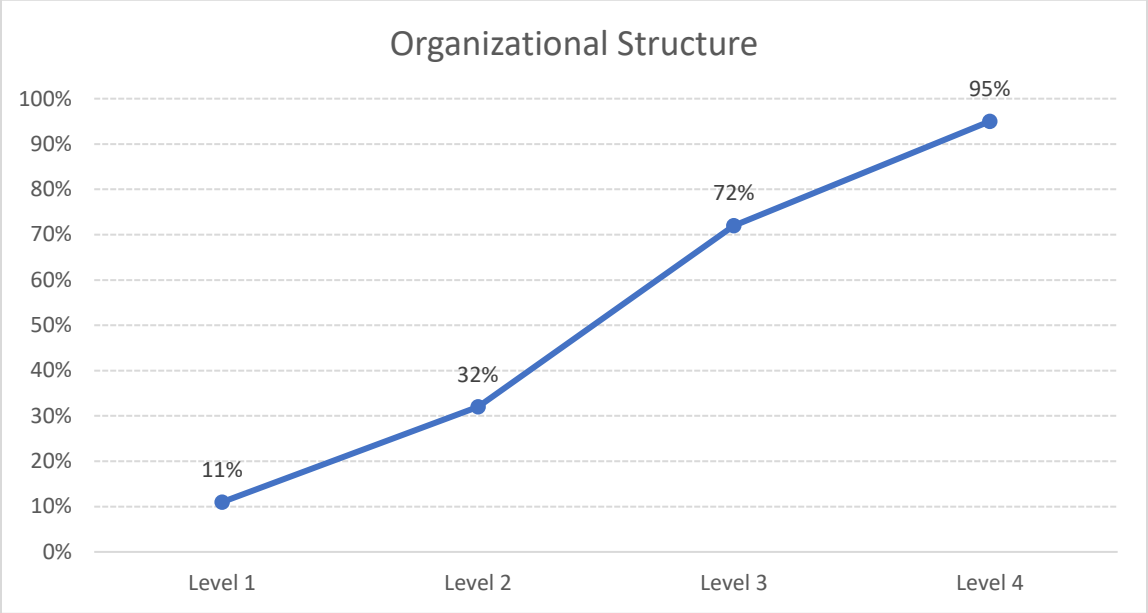


Figure 36: Organizational Structure Desirability Curve

Level	Description	Desirability
Level 1	Organizational structure is siloed based on product families, and all new customer requests need to be channeled through departments	11%
Level 2	Organizational structure is siloed based on product families, and new customer requests are handled by cross-functional teams	32%
Level 3	The organization uses a matrix structure is handled customer needs	72%
Level 4	All departments of the organization are structured based on customer needs	95%

Table 36: Organizational Structure Desirability Curve Values

Cultural Strength

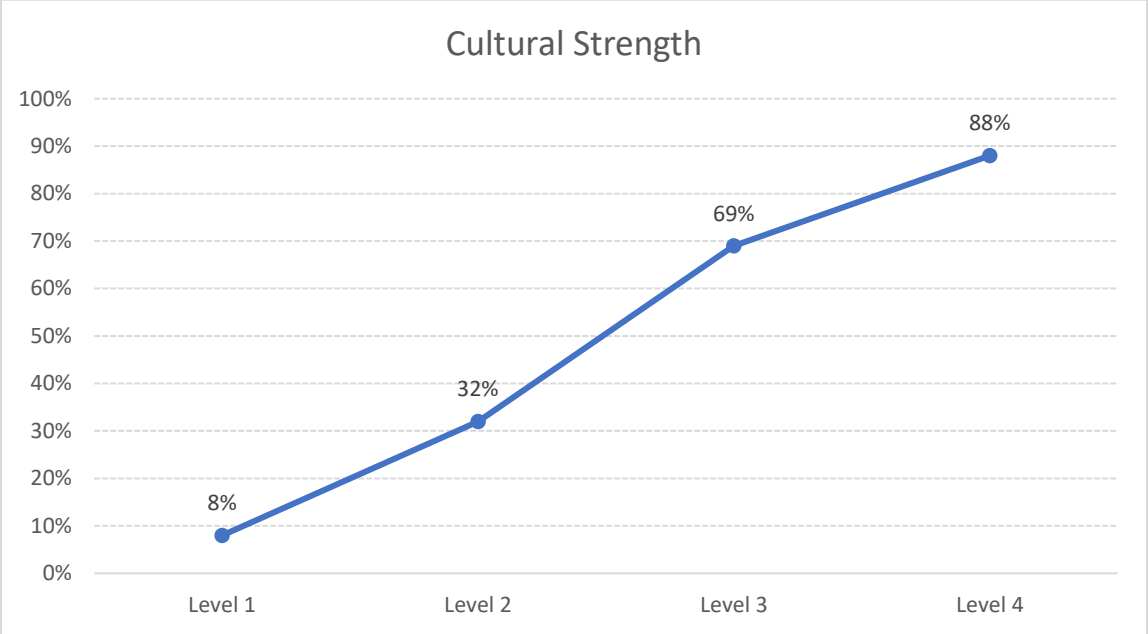


Figure 37: Cultural Strength Desirability Curve

Level	Description	Desirability
Level 1	The culture of the organization is fully product-centric, and customer needs don't impact internal interactions	8%
Level 2	The culture of the organization is impacted moderately by the needs and voices of customers	32%
Level 3	The culture of the organization is impacted Highly by the needs and voices of customers	69%
Level 4	The culture of the organization is driven by the needs and voices of customers	88%

Table 37: Cultural Strength Desirability Curve Values

Strategy Focus

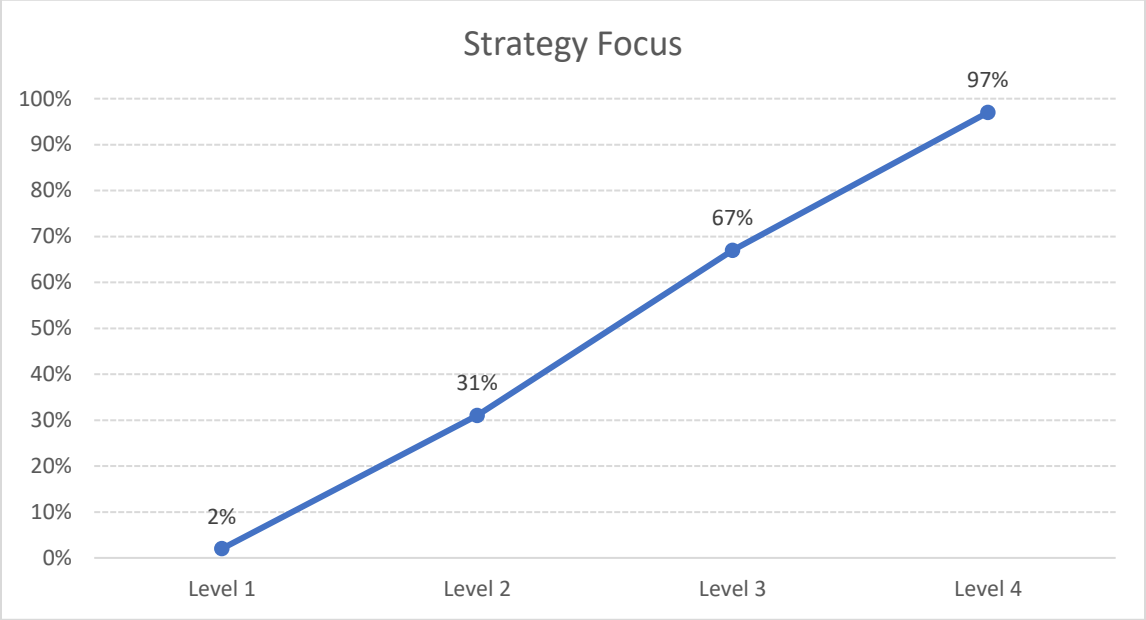


Figure 38: Strategy Focus Desirability Curve

Level	Description	Desirability
Level 1	The organization strategy doesn't consider customer-centric approaches at all	2%
Level 2	The organization strategy includes some sections for moving toward a customer-centric approach	31%
Level 3	Most of the organization strategy is designed with the customer-centric approach in scope	67%
Level 4	The organization strategy is designed with the core of the customer-centric approach	97%

Table 38: Strategy Focus Desirability Curve Values

Staff Expertise

Figure 39: Staff Expertise Desirability Curve

Level	Description	Desirability
Level 1	The employees are not familiar with customer needs	1%
Level 2	The employees are familiar with customer needs but can't take many actions to fulfill them	28%
Level 3	The employees know the customer needs and can take action to fulfill them	68%
Level 4	The employees know the customer needs and are trained on how to fulfill them	100%

Table 39: Staff Expertise Desirability Curve Values

Leadership Support

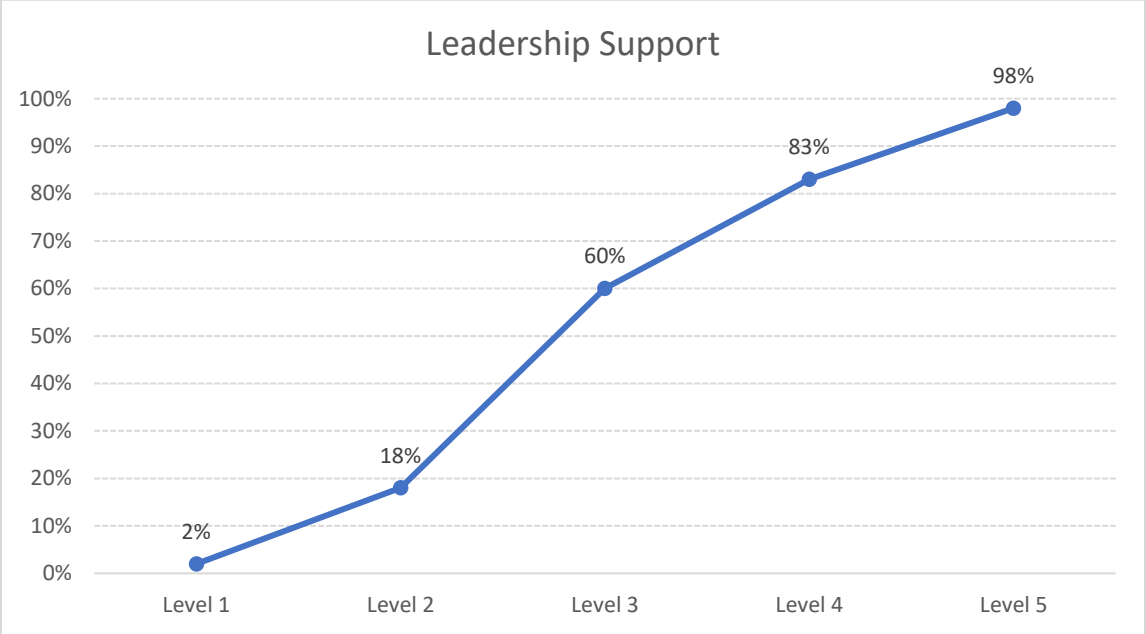


Figure 40: Leadership Support Desirability Curve

Level	Description	Desirability
Level 1	Organization leadership are not familiar with a customer-centric organization	2%
Level 2	Organization leadership know about the basics of customer organization but don't buy-in	18%
Level 3	Organization leadership know about a customer-centric organization and support it	60%
Level 4	Organization leadership support a customer-centric organization and take action to improve it	83%
Level 5	Organization leadership decision making is fully based on a customer-centric approach	98%

Table 40: Leadership Support Desirability Curve Values

Financial

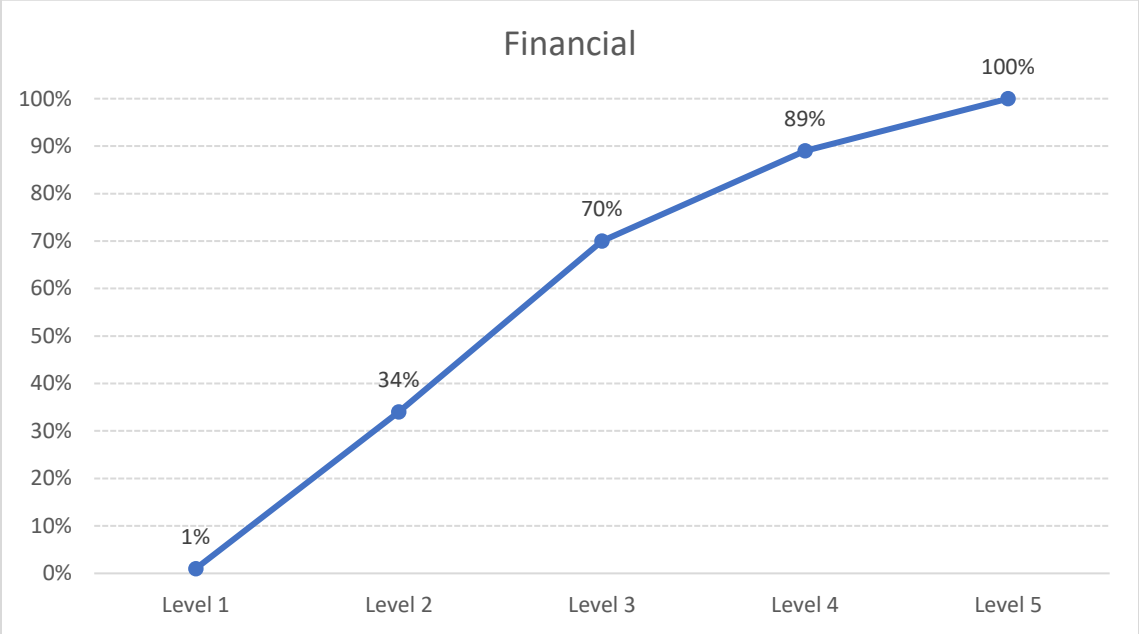


Figure 41: Financial Desirability Curve

Level	Description	Desirability
Level 1	The organization is in loss and no profit registered for the past two years	1%
Level 2	The organization was moderately profitable in the previous two years	34%
Level 3	The organization was highly profitable in the previous two years	70%
Level 4	The organization was exponentially profitable during the last two years	89%
Level 5	The organization was exponentially profitable during the last five years	100%

Table 41: Financial Desirability Curve Values

Customer Perspective

Awareness and Training

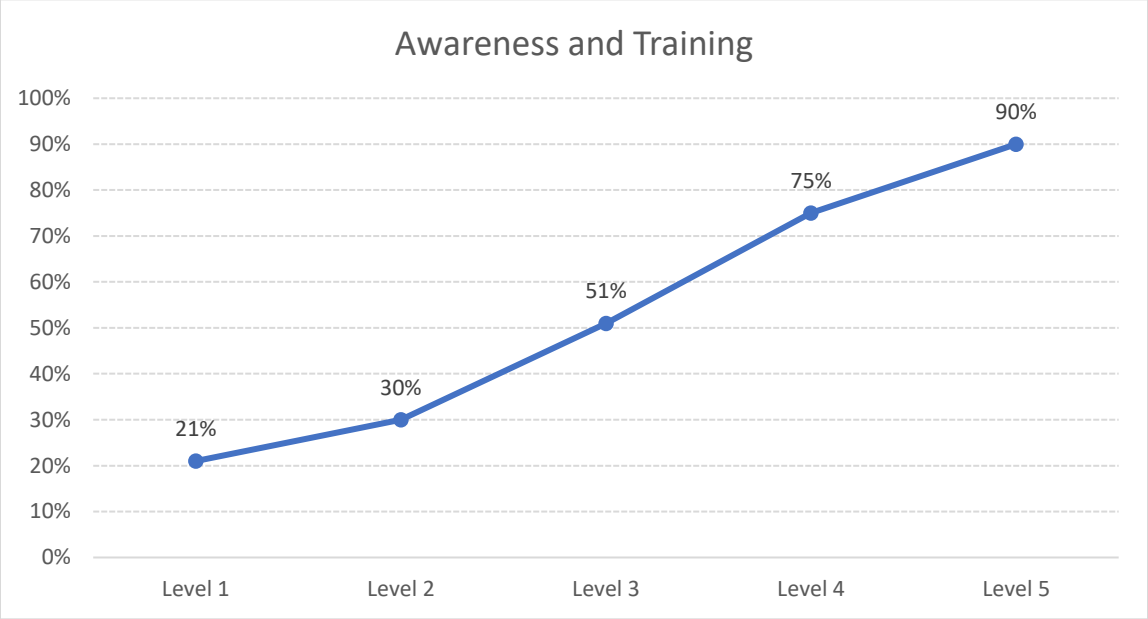


Figure 42: Awareness and Training Desirability Curve

Level	Description	Desirability
Level 1	Customer has not heard of any products or services of the company	21%
Level 2	Customer has heard the name of the company but not products or services	30%
Level 3	Customer is familiar with the company and few products or services	51%
Level 4	Customer is familiar with the company and most products or services	75%
Level 5	Customer is familiar with the company and has got training on how to use products or services	90%

Table 42: Awareness and Training Desirability Curve Values

Satisfaction

Figure 43: Satisfaction Desirability Curve

Level	Description	Desirability
Level 1	customer is unhappy with products or services and spread negative word-of-mouth	20%
Level 2	customer is satisfied but unenthusiastic to recommend the product or services to others	43%
Level 3	customer is loyal to products and services and keeps referring other customers to the company	100%

Table 43: Satisfaction Desirability Curve Values

Expectation

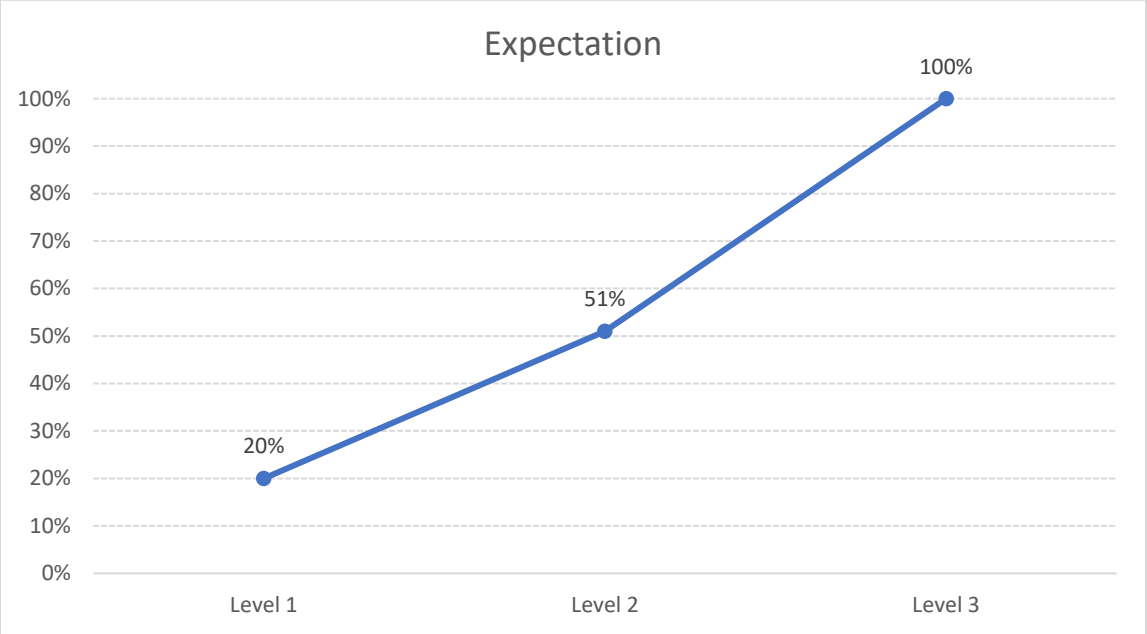


Figure 44: Expectation Desirability Curve

Level	Description	Desirability
Level 1	The products and services do not match with customer needs	20%
Level 2	The products and services do match with some of the customers' needs but require many changes	51%
Level 3	The products and services are designed and developed to entirely fulfill customer expectations	100%

Table 44: Expectation Desirability Curve Values

Loyalty and commitment

Figure 45: Loyalty and commitment Desirability Curve

Level	Description	Desirability
Level 1	customer is never going to purchase the services or products again	6%
Level 2	customer is going to purchase again if there are no other competitive offerings in the market	38%
Level 3	customer is going to purchase again even if the offering of other companies are same or even better	99%

Table 45: Loyalty and commitment Desirability Curve Values

Policy Perspective

Data Privacy Compliance

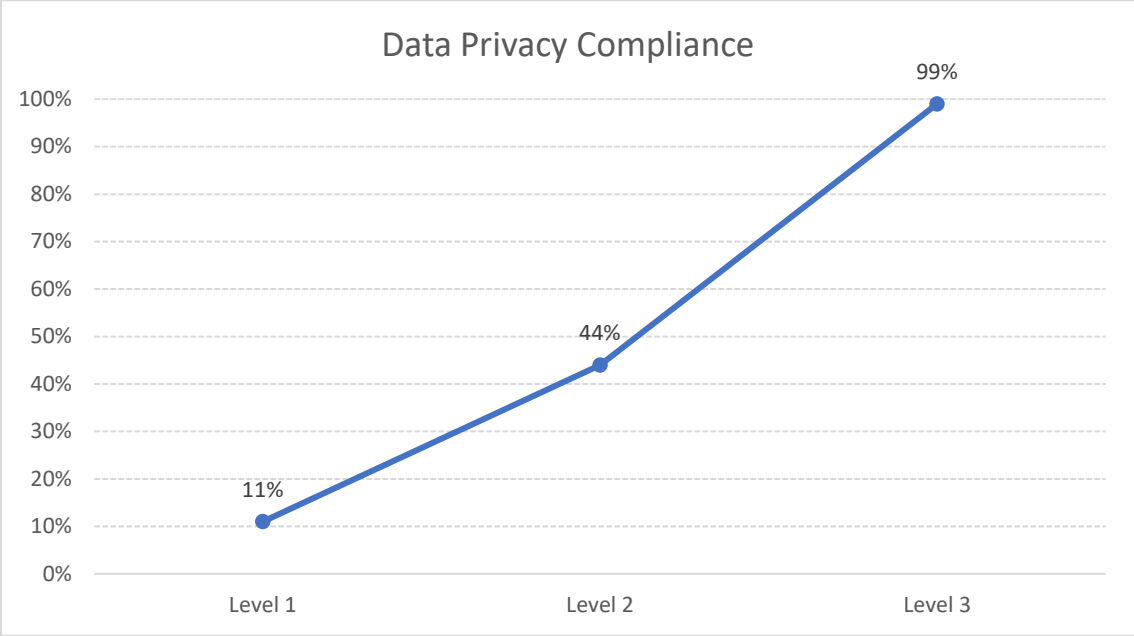


Figure 46: Data Privacy Compliance Desirability Curve

Level	Description	Desirability
Level 1	The data management practices in the organization are NOT Compliant with local, regional, and global customer information privacy requirements	11%
Level 2	The data management practices in the organization, to some degrees, are compliant with local, regional, and global customer information privacy requirements	44%
Level 3	The data management practices in the organization are fully designed in compliance with local, regional, and global customer information privacy requirements	99%

Table 46: Data Privacy Compliance Desirability Curve Values

Data Security Compliance

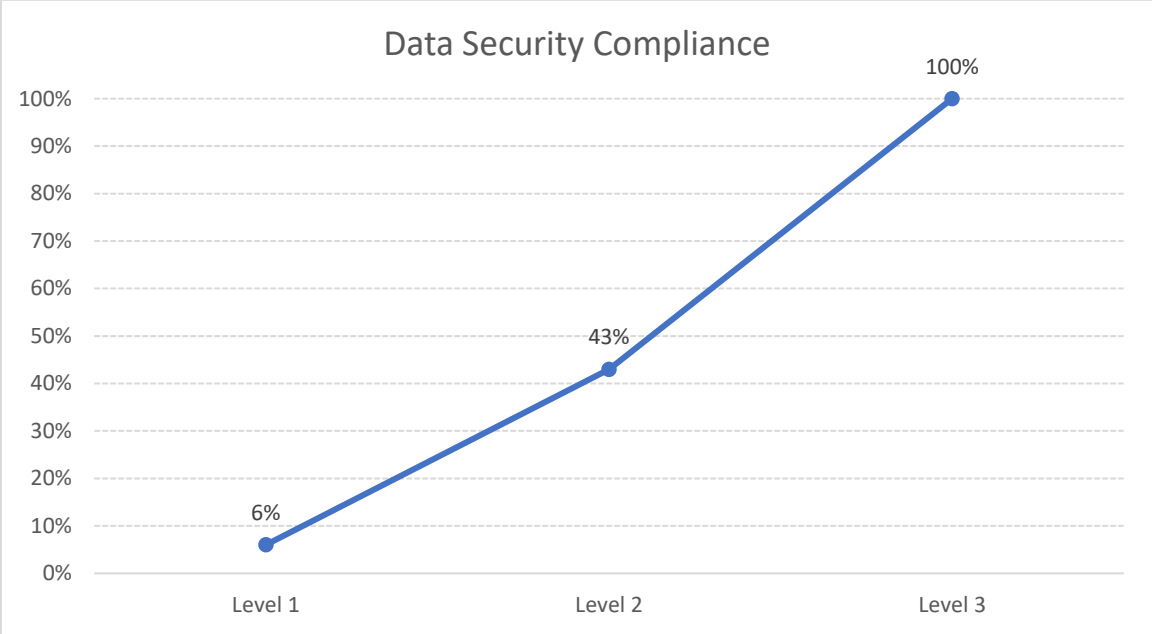


Figure 47: Data Security Compliance Desirability Curve

Level	Description	Desirability
Level 1	The data management practices in the organization are NOT Compliant with local, regional, and global customer information security requirements	6%
Level 2	The data management practices in the organization, to some degrees, are compliant with local, regional, and global customer information security requirements	43%
Level 3	The data management practices in the organization are fully designed in compliance with local, regional, and global customer information security requirements	100%

Table 47: Data Security Compliance Desirability Curve Values

Data Ownership

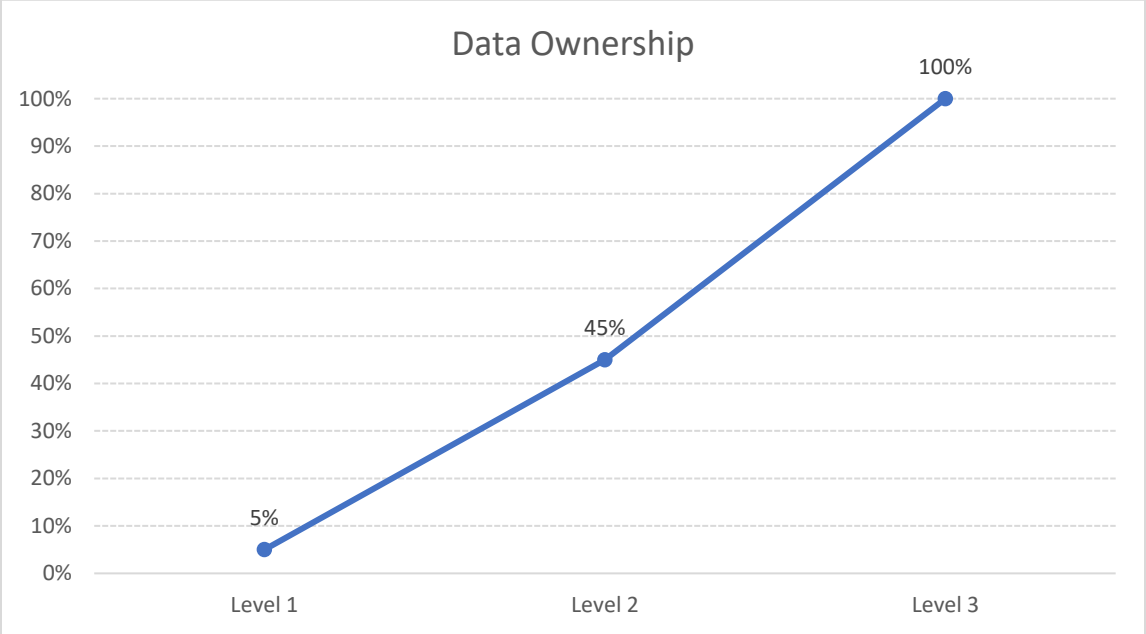


Figure 48: Data Ownership Desirability Curve

Level	Description	Desirability
Level 1	The data ownership is not clearly assigned to particular people, roles, departments	5%
Level 2	The data ownership is to some degree assigned to particular people, roles, departments	45%
Level 3	The owners of each data resources are clearly defined, and people, roles, and departments are clear about it	100%

Table 48: Data Ownership Desirability Curve Values

Data Governance

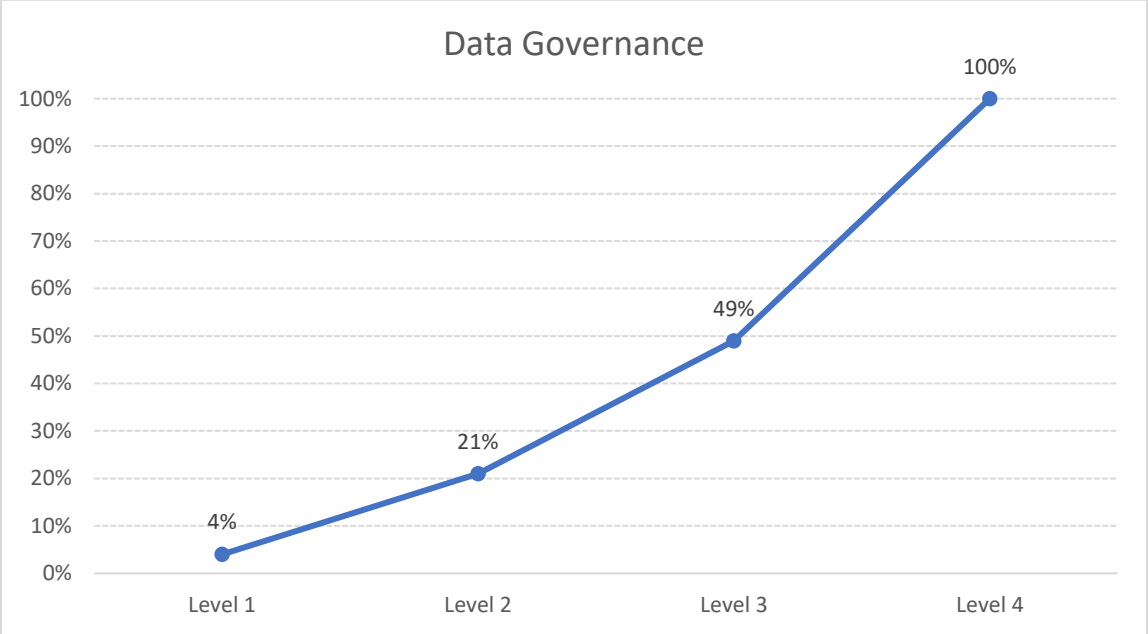


Figure 49: Data Governance Desirability Curve

Level	Description	Desirability
Level 1	The organization don't follow any specific data governance practices	4%
Level 2	The organization follows some data governance practices which are informally communicated with departments	21%
Level 3	The organization follows some formal data governance practices and gradually expending them to all data resources	49%
Level 4	The organization follows formal data governance practices that encompass all presently accessible data resources	100%

Table 49: Data Governance Desirability Curve Values

Case Studies

In this research, the case study method is used to demonstrate the application of the model built during this research. The case study also provides another layer of validation and verification for the model in the real world.

To perform a thorough case study, access to information and experts is very critical. One of the reasons for selecting this organization for the case study was the availability of the data to the author and direct access to the experts for SME panel formation.

The quantified model is validated using the case study. The organization's maturity level in the Customer-centricity approach is evaluated, scored, and used as the baseline to enhance its overall customer orientation. During the case study, the criteria, perspective, and desirability with lower scores are identified that are used as the areas for improvement for the organization.

Company profiles

Since the data for perspectives and criteria used in the model are not publicly available to illustrate the performance of the model in real-world and the researcher do not have access to such detailed information for a large organization, in order to demonstrate the proposed model at work, two case studies are performed in this research. In Case Study 1, three hypothetical companies are used to perform the case study.[217] Later in this chapter, the profile of these hypothetical companies are defined and used for case analysis. In Case Study 2, the researcher performed another

case study analysis based on his access to different sources, mainly through the researcher network.

Case Study 1

For case study 1, each hypothetical company is associated with alternative characteristics to differentiate them from one another and illustrate the real situation outcome in a comparative manner.

In other words, these hypothetical companies possess variant strengths and weaknesses in each perspective and criteria, which is modeled in the research.

The figure below shows the variation of the Hypothetical companies and their strength and weaknesses in different factor groups

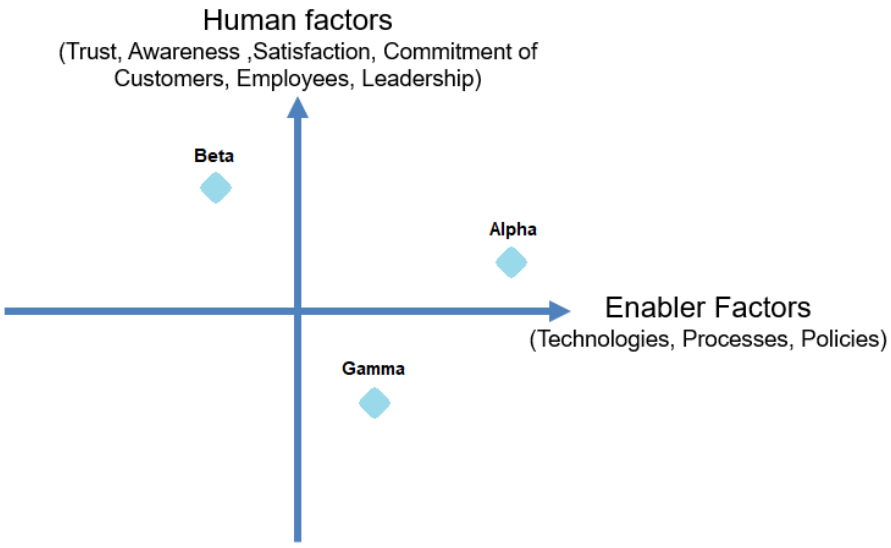


Figure 50: Variation of Hypothetical Companies

In order to elaborate on the differences between the hypothetical companies, a narrative introduction is brought up in the below section. Further on, based on the variation chart and narrative introduction of the companies, desirability values are assigned to each criterion.

Company Alpha

Tech Savvy; Strategic Leadership; Customer Negligent; Policy master

Company Alpha is an online retailer firm that gets high scores regarding technology stacks and data management but lacks specific customer relationship management capabilities. They use robust methods to collect and distribute data in the organization. They have built a solid and flexible infrastructure for information technology and pursue cutting-edge technologies for data and IT management constantly. The leadership entirely supports the customer-centricity initiatives, and the official strategic plans of the organization include customer-centric alignment. However, their communication with the customers is not consistent and takes a long time to respond to any customer support requests. Customers are rarely informed of new products or innovations of the company, and loyalty programs initiated a few years back are not efficient and have high customer turnover. In addition, the staff is not trained with customers in mind, and their skills are incentivized based on product management or technical skills.

The table below presents the levels of customer-centricity for Company Alpha:

Perspective	Criteria	Level number	Level Definition
Technology/ Data	Technology Infrastructure and Integration	Level 4	High level of integration
	Data Distribution and Accessibility	Level 5	Required data is always accessible when and where needed within an organization
	Data Collection Robustness	Level 4	The data collection methods provide ready to use data that is comprehensive and reliable
	Data Metrics Clarity	Level 3	The data metrics definitions are fully organized and provide fully usable data, which requires some elaboration
	Data Analytics Capabilities	Level 3	Most of the operational activities are driven by data analytics
Organization	Process Robustness	Level 2	The processes are developed based on efficient product/service design with some flexibility to adjust customer needs
	Organizational Structure	Level 3	The organization uses a matrix structure is handled customer needs
	Cultural Strength	Level 3	The culture of the organization is impacted Highly by the needs and voices of customers
	Strategy Focus	Level 4	The organization strategy is designed with the core of the customer-centric approach
	Staff Expertise	Level 1	The employees are not familiar with customer needs

	Leadership Support	Level 5	Organization leadership decision making is fully based on a customer-centric approach
	Financial	Level 2	The organization was moderately profitable in the previous two years
Customer	Awareness and Training	Level 2	Customer has heard the name of the company but not products or services
	Satisfaction	Level 2	customer is satisfied but unenthusiastic to recommend the product or services to others
	Expectation	Level 2	The products and services do match with some of the customers' needs but require many changes
	Loyalty and commitment	Level 2	customer is going to purchase again if there are no other competitive offerings in the market
Policy	Data Privacy Compliance	Level 3	The data management practices in the organization are fully designed in compliance with local, regional, and global customer information privacy requirements
	Data Security Compliance	Level 3	The data management practices in the organization are fully designed in compliance with local, regional, and global customer information security requirements
	Data Ownership	Level 3	The owners of each data resources are clearly defined, and people, roles, and departments are clear about it
	Data Governance	Level 3	The organization follows some formal data governance practices and gradually expending them to all data resources

Table 50: customer-centricity Assessment for Company Alpha

Company Beta

Tech Laggard; Mature Organization; Customer repeller; Policy Obedient

Company Beta is a highly structured organization with robust and established processes, and they follow the restrictive data privacy policies, but the technologies are obsolete and non-scalable, which negatively impacts the data distribution and accessibility. They started an e-commerce website to market and sold their products five years ago but struggled with attracting customers to their e-commerce website. This is an old company with traditional siloed structures with minimum flexibility in synergy and compounding of separate teams' efforts. They invest heavily in customer awareness and training and attempt to acquire more customers through marketing initiatives, but their customer ratings are moderate, and they have difficulty in building long-term relationships with customers. They follow the policies strictly in order to stay away from any legal challenges and lawsuits, but data governance and ownership initiatives lack uniform leadership and cause confusion among the internal users.

The technology stack was upgraded 15 years ago, and digital transformation has been a challenge since then. Therefore, the organization does not possess the modern IT and data infrastructure needed for the delivery of customer-centric capabilities for internal teams.

The table below presents the levels of customer-centricity from different perspectives for Company Beta:

Perspective	Criteria	Level number	Level Definition
Technology/ Data	Technology Infrastructure and Integration	Level 2	A minimum level of integration
	Data Distribution and Accessibility	Level 2	30% of required data is accessible when and where needed within an organization
	Data Collection Robustness	Level 1	The data collection methods are ineffective and don't provide reliable and usable data
	Data Metrics Clarity	Level 1	The data metrics definitions are ineffective and don't provide reliable and useful data
	Data Analytics Capabilities	Level 2	Few departments use data analytics for limited operational decision making
Organization	Process Robustness	Level 2	The processes are developed based on efficient product/service design with some flexibility to adjust customer needs
	Organizational Structure	Level 4	All departments of the organization are structured based on customer needs
	Cultural Strength	Level 3	The culture of the organization is impacted Highly by the needs and voices of customers
	Strategy Focus	Level 3	Most of the organization strategy is designed with the customer-centric approach in scope
	Staff Expertise	Level 3	The employees know the customer needs and can take action to fulfill them

	Leadership Support	Level 4	Organization leadership support a customer-centric organization and take action to improve it
	Financial	Level 5	The organization was exponentially profitable during the last five years
Customer	Awareness and Training	Level 4	Customer is familiar with the company and most products or services
	Satisfaction	Level 2	customer is satisfied but unenthusiastic to recommend the product or services to others
	Expectation	Level 2	The products and services do match with some of the customers' needs but require many changes
	Loyalty and commitment	Level 2	customer is going to purchase again if there are no other competitive offerings in the market
Policy	Data Privacy Compliance	Level 3	The data management practices in the organization are fully designed in compliance with local, regional, and global customer information privacy requirements
	Data Security Compliance	Level 3	The data management practices in the organization are fully designed in compliance with local, regional, and global customer information security requirements
	Data Ownership	Level 2	The data ownership is to some degree assigned to particular people, roles, departments
	Data Governance	Level 3	The organization follows some formal data governance practices and gradually expending them to all data resources

Table 51: customer-centricity Assessment for Company Beta

Company Gamma

Tech Master; Affluent but wasteful; Alienated Customers; Policy Ignorant

Company Gamma is an agile and flexible start-up that utilizes new technologies to deliver innovative solutions to customers through its website. The customers can buy the products directly from their e-commerce website and request customization and delivery. Although Company Gamma can customize their solution based on customer needs, they don't have a strong footprint in the market, and customers are not familiar with their products and services. They do not follow well-structured processes and policies and miss a few of the checkboxes in the privacy and security policies. The table below presents the levels of customer-centricity from different perspectives for Company Gamma:

Perspective	Criteria	Level number	Level Definition
Technology /Data	Technology Infrastructure and Integration	Level 4	High level of integration
	Data Distribution and Accessibility	Level 4	70% of required data is accessible when and where needed within an organization
	Data Collection Robustness	Level 2	The data collection methods are semi-structured and provide some usable data
	Data Metrics Clarity	Level 3	The data metrics definitions are fully organized and provide fully usable data, which requires some elaboration
	Data Analytics Capabilities	Level 4	Most of the operational activities and some of the strategic decisions are driven by data analytics

Organization	Process Robustness	Level 2	The processes are developed based on efficient product/service design with some flexibility to adjust customer needs
	Organizational Structure	Level 2	Organizational structure is siloed based on product families, and new customer requests are handled by cross-functional teams
	Cultural Strength	Level 2	The culture of the organization is impacted moderately by the needs and voices of customers
	Strategy Focus	Level 3	Most of the organization strategy is designed with the customer-centric approach in scope
	Staff Expertise	Level 2	The employees are familiar with customer needs but can't take many actions to fulfill them
	Leadership Support	Level 3	Organization leadership know about a customer-centric organization and support it
	Financial	Level 4	The organization was exponentially profitable during the last two years
Customer	Awareness and Training	Level 1	Customer has not heard of any products or services of the company
	Satisfaction	Level 2	customer is satisfied but unenthusiastic to recommend the product or services to others
	Expectation	Level 1	The products and services do not match with customer needs

	Loyalty and commitment	Level 1	customer is never going to purchase the services or products again
Policy	Data Privacy Compliance	Level 2	The data management practices in the organization are fully designed in compliance with local, regional, and global customer information privacy requirements
	Data Security Compliance	Level 2	The data management practices in the organization are fully designed in compliance with local, regional and global customer information security requirements
	Data Ownership	Level 1	The data ownership is to some degree assigned to particular people, roles, departments
	Data Governance	Level 1	The organization follows some formal data governance practices and gradually expending them to all data resources

Table 52: customer-centricity Assessment for Company Gamma

Case Study Analysis

The Customer-Centricity Approach for companies in the case study is calculated through the following formula (see Chapter four for more details)

$$S_{CC} = \sum_{i=1}^{m}\sum_{j=1}^{n}(P_j)(C_{i,j})(D_{i,j})$$

Where

S_{CC} is the Customer-centricity Score

P_j is the relative value of perspective j with respect to Customer-centricity Score

$$where\ j = 1,2,\dots,n$$

$C_{i,j}$ is the relative value of criteria i under perspective j with respect to Customer-centricity Score

$$where\ j = 1,2,\dots,n\ \ AND\ i = 1,2,\dots,m$$

$D_{i,j}$ is the Desirability value of criteria i under perspective j

$$where\ j = 1,2,\dots,n\ \ AND\ i = 1,2,\dots,m$$

The tables below present the detailed values for Perspectives, Criteria and Desirability, and customer-centricity score for each company in case study 1.

Company Alpha Customer-centricity Score Calculations

Perspective	Criteria	Global Weights (GW)	Level number	Desirability Value (DV)	GW X DV
Technology/ Data	Technology Infrastructure and Integration	5.13%	Level 4	80.00%	4.10%
	Data Distribution and Accessibility	3.80%	Level 5	100.00%	3.80%
	Data Collection Robustness	2.66%	Level 4	100.00%	2.66%
	Data Metrics Clarity	2.66%	Level 3	72.00%	1.92%
	Data Analytics Capabilities	4.56%	Level 3	59.00%	2.69%
Organization	Process Robustness	2.97%	Level 2	43.00%	1.28%
	Organizational Structure	2.70%	Level 3	72.00%	1.94%
	Cultural Strength	4.86%	Level 3	69.00%	3.35%
	Strategy Focus	4.05%	Level 4	97.00%	3.93%
	Staff Expertise	3.78%	Level 1	1.00%	0.04%
	Leadership Support	5.40%	Level 5	98.00%	5.29%

	Financial	3.51%	Level 2	34.00%	1.19%
Customer	Awareness and Training	5.28%	Level 2	30.00%	1.58%
	Satisfaction	11.55%	Level 2	43.00%	4.97%
	Expectation	10.23%	Level 2	51.00%	5.22%
	Loyalty and commitment	6.27%	Level 2	38.00%	2.38%
Policy	Data Privacy Compliance	5.22%	Level 3	99.00%	5.17%
	Data Security Compliance	5.76%	Level 3	100.00%	5.76%
	Data Ownership	3.24%	Level 3	100.00%	3.24%
	Data Governance	3.78%	Level 3	49.00%	1.85%
			Customer-centricity Score		62.4%

Table 53: Company Alpha Customer-centricity Score Calculations

Company Beta Customer-centricity Score Calculations

Perspective	Criteria	Global Weights (GW)	Level number	Desirability Value (DV)	GW X DV
Technology / Data	Technology Infrastructure and Integration	5.13%	Level 2	23.00%	1.18 %
	Data Distribution and Accessibility	3.80%	Level 2	30.00%	1.14 %
	Data Collection Robustness	2.66%	Level 1	2.00%	0.05 %
	Data Metrics Clarity	2.66%	Level 1	5.00%	0.13 %
	Data Analytics Capabilities	4.56%	Level 2	30.00%	1.37 %
Organization	Process Robustness	2.97%	Level 2	43.00%	1.28 %
	Organizational Structure	2.70%	Level 4	95.00%	2.57 %
	Cultural Strength	4.86%	Level 3	69.00%	3.35 %
	Strategy Focus	4.05%	Level 3	67.00%	2.71 %
	Staff Expertise	3.78%	Level 3	68.00%	2.57 %
	Leadership Support	5.40%	Level 4	83.00%	4.48 %
	Financial	3.51%	Level 5	100.00 %	3.51 %

Customer	Awareness and Training	5.28%	Level 4	75.00%	3.96 %
	Satisfaction	11.55 %	Level 2	43.00%	4.97 %
	Expectation	10.23 %	Level 2	51.00%	5.22 %
	Loyalty and commitment	6.27%	Level 2	38.00%	2.38 %
Policy	Data Privacy Compliance	5.22%	Level 3	99.00%	5.17 %
	Data Security Compliance	5.76%	Level 3	100.00 %	5.76 %
	Data Ownership	3.24%	Level 2	45.00%	1.46 %
	Data Governance	3.78%	Level 3	49.00%	1.85 %
			Customer-centricity Score		55.1 %

Table 54: Company Beta Customer-centricity Score Calculations

Company Gamma Customer-centricity Score Calculations

Perspective	Criteria	Global Weights (GW)	Level number	Desirability Value (DV)	GW X DV
Technology / Data	Technology Infrastructure and Integration	5.13%	Level 4	80.00 %	4.10 %
	Data Distribution and Accessibility	3.80%	Level 4	68.00 %	2.58 %
	Data Collection Robustness	2.66%	Level 2	30.00 %	0.80 %
	Data Metrics Clarity	2.66%	Level 3	72.00 %	1.92 %
	Data Analytics Capabilities	4.56%	Level 4	77.00 %	3.51 %
Organization	Process Robustness	2.97%	Level 2	43.00 %	1.28 %
	Organizational Structure	2.70%	Level 2	32.00 %	0.86 %
	Cultural Strength	4.86%	Level 2	32.00 %	1.56 %
	Strategy Focus	4.05%	Level 3	67.00 %	2.71 %
	Staff Expertise	3.78%	Level 2	28.00 %	1.06 %
	Leadership Support	5.40%	Level 3	60.00 %	3.24 %
	Financial	3.51%	Level 4	89.00 %	3.12 %

Customer	Awareness and Training	5.28%	Level 1	21.00 %	1.11 %
	Satisfaction	11.55 %	Level 2	43.00 %	4.97 %
	Expectation	10.23 %	Level 1	20.00 %	2.05 %
	Loyalty and commitment	6.27%	Level 1	6.00%	0.38 %
Policy	Data Privacy Compliance	5.22%	Level 2	44.00 %	2.30 %
	Data Security Compliance	5.76%	Level 2	43.00 %	2.48 %
	Data Ownership	3.24%	Level 1	5.00%	0.16 %
	Data Governance	3.78%	Level 1	4.00%	0.15 %
			Customer-centricity Score		40.3 %

Table 55: Company Gamma Customer-centricity Score Calculations

Score Improvement recommendations

In this section, the researcher provides recommendations to improve the customer-centricity approach in companies Alpha, Beta, and Gamma according to the calculated customer-centricity scores. The case study analysis on three hypothetical companies shows that the customer-centricity score of the companies Alpha, Beta, and Gamma are 62.4%, 55.1%, and 40.3%, respectively. For all three companies, there are many opportunities to improve customer-centricity. In the following section, a few of the gaps and improvement opportunities are discussed for each company separately.

Company Alpha

The company Alpha got the lowest score in Staff Expertise. The training of the employees and lack of the communication skills to interact with customers is the main gap that is identified in their customer-centricity approach. The other factors that reduced the score for company Alpha were "customer awareness and Training" and also building "Loyalty and commitment" among customers.

Company Alpha can improve its customer-centricity approach by designing and implementing marketing campaigns surrounding the customers' awareness about their brand and products. In addition, training the employees with customer interaction skills can improve customer-centricity in this company.

Company Beta

The company Beta got the lowest scores from the criteria under the Technology perspective. The data collection processes of the organization are ad hoc and are not solidified based on customer needs. The data metrics are not clearly defined, and internal employees have

ambiguity about data metrics and what they represent in the customer-centricity approach. On the other hand, the technology infrastructure and data distribution are not revised for a long time and are negatively impacting the data collection, analysis, and distribution in the organization.

The Company Beta can improve its customer-centricity, focusing on digital transformation and technology renovation. They need to clearly define the data metrics and how they can be collected from reliable sources. In addition, the process for data collection and data analysis needs to be revised in order to enhance the customer-centricity approach in the company.

Company Gamma

The company Gamma got the lowest score from the loyalty and commitment of the customers. The company considers its customers as transactional and one-time buyers and has not planned on returning customers to buy again and making them loyal to the brand and products of this company. Besides that, the customers are aware of just a few flagship products of the company, which doesn't entirely fulfill their expectations.

On the other hand, siloed organizational structures prevent the departments from focusing on and addressing customer needs. The staff is not well trained for customer interactions, and there is a gap of knowledge on how to communicate and interact with the customers among the staff.

The company Gamma can improve the customer-centricity approach, starting with a solid loyalty program design that addresses the customer needs at every touchpoint along the customer journey. They need to build a long-term relationship with customers to understand their expectations. In addition, in order to deliver according to the customers' expectations and needs, there is a need to restructure the organization based on customer segments.

Centralized management of the customer needs based on target customers enables them to customize their products faster and have a more loyal customer base.

Sensitivity Analysis

Sensitivity analysis measures the reliability and confidence level of the model, which is built based on expert judgments. In other words, sensitivity analysis evaluates different levels of values and changes that are introduced to the model and provides the researcher with enough information about the limits of the model and different scenarios that the model is/is not applicable.

The sensitivity analysis is important to be applied in such research as the factors impacting the outcome may change over time which is highly probable when the technology is one of the core components of the model. The rapid changes in the technology may require frequent changes or updates on the model to confirm it is still valid and relevant to the problem and outcome.

Following sensitivity analysis made by Estep[218] and Abotah[279] and after the data collection and model development, sensitivity analysis is performed to confirm the impact of the changes in priority in perspectives in the ultimate customer-centricity score. In this research, scenario analysis is applied to the model to assess the behavior of the model under extreme inputs and determine the robustness of the model.

The following tables present the calculation of the sensitivity based on boosting each of the perspectives (scenarios 1 through 4) and evaluating the impact on the final customer-centricity scores in each company.

Scenario 1: Emphasis on Technology/Data Perspective

Table 56: Sensitivity Analysis Scenario 1

Perspective	Baseline Weight	Perspective Local Weight	Criteria	Criteria Local Weight	Global Weight (PW x CW)	Company Alpha Local Score	Company Beta Local Score	Company Gamma Local Score
Technology/Data	0.19	0.97	Technology Infrastructure and Integration	0.27	0.262	0.210	0.060	0.210
Technology/Data	0.19	0.97	Data Distribution and Accessibility	0.20	0.194	0.194	0.058	0.132
Technology/Data	0.19	0.97	Data Collection Robustness	0.14	0.136	0.136	0.003	0.041
Technology/Data	0.19	0.97	Data Metrics Clarity	0.14	0.136	0.098	0.007	0.098
Technology/Data	0.19	0.97	Data Analytics Capabilities	0.24	0.233	0.137	0.070	0.179
Organization	0.27	0.01	Process robustness	0.11	0.001	0.000	0.000	0.000
Organization	0.27	0.01	Organizational Structure	0.10	0.001	0.001	0.001	0.000
Organization	0.27	0.01	Cultural Strength	0.18	0.002	0.001	0.001	0.001
Organization	0.27	0.01	Strategy focus	0.15	0.002	0.001	0.001	0.001
Organization	0.27	0.01	Staff Expertise	0.14	0.001	0.000	0.001	0.000
Organization	0.27	0.01	Leadership Support	0.20	0.002	0.002	0.002	0.001
Organization	0.27	0.01	Financials	0.13	0.001	0.000	0.001	0.001
Customer	0.33	0.01	Awareness and Training	0.16	0.002	0.000	0.001	0.000
Customer	0.33	0.01	Satisfaction	0.35	0.004	0.002	0.002	0.002
Customer	0.33	0.01	Expectation	0.31	0.003	0.002	0.002	0.001
Customer	0.33	0.01	Loyalty and commitment	0.19	0.002	0.001	0.001	0.000
Policy	0.18	0.01	Data Privacy Compliance	0.29	0.003	0.003	0.003	0.001
Policy	0.18	0.01	Data Security Compliance	0.32	0.003	0.003	0.003	0.001
Policy	0.18	0.01	Data Ownership	0.18	0.002	0.002	0.001	0.000
Policy	0.18	0.01	Data Governance	0.21	0.002	0.001	0.001	0.000

	Company Alpha	Company Beta	Company Gamma
Base line values	0.62	0.55	0.40
Scenario 1 results	0.79	0.22	0.67
Difference	0.17	-0.33	0.27

Max difference	0.60
Std. Deviation	0.26

Scenario 2: Emphasis on Organization Perspective

Table 57: Sensitivity Analysis Scenario 2

Perspective	Baseline Weight	Perspective Local Weight	Criteria	Criteria Local Weight	Global Weight (PW x CW)	Company Alpha Local Score	Company Beta Local Score	Company Gamma Local Score
Technology/Data	0.19	0.01	Technology Infrastructure and Integration	0.27	0.003	0.002	0.001	0.002
Technology/Data	0.19	0.01	Data Distribution and Accessibility	0.20	0.002	0.002	0.001	0.001
Technology/Data	0.19	0.01	Data Collection Robustness	0.14	0.001	0.001	0.000	0.000
Technology/Data	0.19	0.01	Data Metrics Clarity	0.14	0.001	0.001	0.000	0.001
Technology/Data	0.19	0.01	Data Analytics Capabilities	0.24	0.002	0.001	0.001	0.002
Organization	0.27	0.97	Process robustness	0.11	0.107	0.046	0.046	0.046
Organization	0.27	0.97	Organizational Structure	0.10	0.097	0.070	0.092	0.031
Organization	0.27	0.97	Cultural Strength	0.18	0.175	0.120	0.120	0.056
Organization	0.27	0.97	Strategy focus	0.15	0.146	0.141	0.097	0.097
Organization	0.27	0.97	Staff Expertise	0.14	0.136	0.001	0.092	0.038
Organization	0.27	0.97	Leadership Support	0.20	0.194	0.190	0.161	0.116
Organization	0.27	0.97	Financials	0.13	0.126	0.043	0.126	0.112
Customer	0.33	0.01	Awareness and Training	0.16	0.002	0.000	0.001	0.000
Customer	0.33	0.01	Satisfaction	0.35	0.004	0.002	0.002	0.002
Customer	0.33	0.01	Expectation	0.31	0.003	0.002	0.002	0.001
Customer	0.33	0.01	Loyalty and commitment	0.19	0.002	0.001	0.001	0.000
Policy	0.18	0.01	Data Privacy Compliance	0.29	0.003	0.003	0.003	0.001
Policy	0.18	0.01	Data Security Compliance	0.32	0.003	0.003	0.003	0.001
Policy	0.18	0.01	Data Ownership	0.18	0.002	0.002	0.001	0.000
Policy	0.18	0.01	Data Governance	0.21	0.002	0.001	0.001	0.000

	Company Alpha	Company Beta	Company Gamma
Base line values	0.62	0.55	0.40
Scenario 2 results	0.63	0.75	0.51
Difference	0.01	0.20	0.11

Max difference	0.19
Std. Deviation	0.08

Scenario 3: Emphasis on Customer Perspective

Table 58: Sensitivity Analysis Scenario 3

Perspective	Baseline Weight	Perspective Local Weight	Criteria	Criteria Local Weight	Global Weight (PW x CW)	Company Alpha Local Score	Company Beta Local Score	Company Gamma Local Score
Technology/Data	0.19	0.01	Technology Infrastructure and Integration	0.27	0.003	0.002	0.001	0.002
Technology/Data	0.19	0.01	Data Distribution and Accessibility	0.20	0.002	0.002	0.001	0.001
Technology/Data	0.19	0.01	Data Collection Robustness	0.14	0.001	0.001	0.000	0.000
Technology/Data	0.19	0.01	Data Metrics Clarity	0.14	0.001	0.001	0.000	0.001
Technology/Data	0.19	0.01	Data Analytics Capabilities	0.24	0.002	0.001	0.001	0.002
Organization	0.27	0.01	Process robustness	0.11	0.001	0.000	0.000	0.000
Organization	0.27	0.01	Organizational Structure	0.10	0.001	0.001	0.001	0.000
Organization	0.27	0.01	Cultural Strength	0.18	0.002	0.001	0.001	0.001
Organization	0.27	0.01	Strategy focus	0.15	0.002	0.001	0.001	0.001
Organization	0.27	0.01	Staff Expertise	0.14	0.001	0.000	0.001	0.000
Organization	0.27	0.01	Leadership Support	0.20	0.002	0.002	0.002	0.001
Organization	0.27	0.01	Financials	0.13	0.001	0.000	0.001	0.001
Customer	0.33	0.97	Awareness and Training	0.16	0.155	0.047	0.116	0.033
Customer	0.33	0.97	Satisfaction	0.35	0.340	0.146	0.146	0.146
Customer	0.33	0.97	Expectation	0.31	0.301	0.153	0.153	0.060
Customer	0.33	0.97	Loyalty and commitment	0.19	0.184	0.070	0.070	0.011
Policy	0.18	0.01	Data Privacy Compliance	0.29	0.003	0.003	0.003	0.001
Policy	0.18	0.01	Data Security Compliance	0.32	0.003	0.003	0.003	0.001
Policy	0.18	0.01	Data Ownership	0.18	0.002	0.002	0.001	0.000
Policy	0.18	0.01	Data Governance	0.21	0.002	0.001	0.001	0.000

	Company Alpha	Company Beta	Company Gamma
Base line values	0.62	0.55	0.40
Scenario 3 results	0.44	0.50	0.26
Difference	-0.18	-0.05	-0.14

Max difference	0.14
Std. Deviation	0.06

Scenario 4: Emphasis on Policy Perspective

Table 59: Sensitivity Analysis Scenario 4

Perspective	Baseline Weight	Perspective Local Weight	Criteria	Criteria Local Weight	Global Weight (PW x CW)	Company Alpha Local Score	Company Beta Local Score	Company Gamma Local Score
Technology/Data	0.19	0.01	Technology Infrastructure and Integration	0.27	0.003	0.002	0.001	0.002
Technology/Data	0.19	0.01	Data Distribution and Accessibility	0.20	0.002	0.002	0.001	0.001
Technology/Data	0.19	0.01	Data Collection Robustness	0.14	0.001	0.001	0.000	0.000
Technology/Data	0.19	0.01	Data Metrics Clarity	0.14	0.001	0.001	0.000	0.001
Technology/Data	0.19	0.01	Data Analytics Capabilities	0.24	0.002	0.001	0.001	0.002
Organization	0.27	0.01	Process robustness	0.11	0.001	0.000	0.000	0.000
Organization	0.27	0.01	Organizational Structure	0.10	0.001	0.001	0.001	0.000
Organization	0.27	0.01	Cultural Strength	0.18	0.002	0.001	0.001	0.001
Organization	0.27	0.01	Strategy focus	0.15	0.002	0.001	0.001	0.001
Organization	0.27	0.01	Staff Expertise	0.14	0.001	0.000	0.001	0.000
Organization	0.27	0.01	Leadership Support	0.20	0.002	0.002	0.002	0.001
Organization	0.27	0.01	Financials	0.13	0.001	0.000	0.001	0.001
Customer	0.33	0.01	Awareness and Training	0.16	0.002	0.000	0.001	0.000
Customer	0.33	0.01	Satisfaction	0.35	0.004	0.002	0.002	0.002
Customer	0.33	0.01	Expectation	0.31	0.003	0.002	0.002	0.001
Customer	0.33	0.01	Loyalty and commitment	0.19	0.002	0.001	0.001	0.000
Policy	0.18	0.97	Data Privacy Compliance	0.29	0.281	0.278	0.278	0.124
Policy	0.18	0.97	Data Security Compliance	0.32	0.310	0.310	0.310	0.133
Policy	0.18	0.97	Data Ownership	0.18	0.175	0.175	0.079	0.009
Policy	0.18	0.97	Data Governance	0.21	0.204	0.100	0.100	0.008

	Company Alpha	Company Beta	Company Gamma
Base line values	0.62	0.55	0.40
Scenario 4 results	0.88	0.78	0.53
Difference	0.26	0.23	0.13

Max difference	0.13
Std. Deviation	0.06

The comparison between different scenarios reveals that the highest impact among the perspectives comes from the "Technology/Data" and criteria under it. On the other hand, the lowest impact is observed "Policy" perspective and criteria associated with it.

Table 60: Sensitivity Analysis Scenarios Deviations and Range difference

	Scenario 1	Scenario 2	Scenario 3	Scenario 4
Absolute Range	0.60	0.19	0.14	0.13
St. Deviation	0.26	0.08	0.06	0.06

The sensitivity analysis performed in this section provides a better understanding of the impact of each perspective on the final customer-centricity score. When the strategic priorities changes in an organization, the overall customer-centricity approach is impacted tremendously.

The HDM model provided us with baseline (preset) weights; however, since the technology management area is changing rapidly, considering the impact of each perspective and criterion on the final score enables the future researchers to obtain a better understanding of the impact of each factor and replacing them with new factors based on the content, context, and structure of their research.

Case Study 2

In case study 2, the data from two companies that the researcher had access to the information was utilized to perform case analysis.

Company C1

This first company, in case study 2, is an SME in the store security products and solutions, which run multiple e-commerce websites to offer their products to the customers. The company was established more than 40 years ago, and the main customers are large electronic businesses that need to secure their devices in the store. The core technologies used in the security devices position them among the top 10 providers in this area. Besides products, this company provides complementary services, which in recent years streamed more or equal levels of revenue compared to product design and manufacturing.

Regarding the technologies utilized in the products, they use cutting-edge solutions; however, the internal technologies are not completely established. The integration of infrastructure is a huge gap in the internal technologies, and data collection methods are not entirely solidified. The data collection challenges present a larger gap in the service business unit than the product business unit as more people are involved in data collection, data audit, data analysis, and data reporting.

From the organization's perspective, the organization has documented the processes; however, the process improvement practices are not frequently used to adapt to changing landscape of customer expectations and requirements. The frequent organizational restructuring resulted in some issues in regard to employee retention as well as customer loyalty. The organization is led by strong leadership with solidified vision; however, the

organization follows multiple strategic initiatives, which make it difficult to cascade it to middle managers and staff. Finally, the organization financially was challenged during the last three years, and the profitability of the organization was impacted negatively. However, no platforms and solutions illustrate a bright future from the financial perspective.

From the Customer perspective, the customer expectation is managed moderately, and regarding the nature of the industry and heavy competition, the loyalty of the customers is minimal. The customer satisfaction is moderate as well since few of the new products and services still have customer experience challenges, and it requires a few more iterations to have fully satisfied customers.

From Policy perspective, the organization follows the required measures for the privacy of customer and employee data. However, they have solid practices for data security, and multiple levels of data protection are applied to make sure a safe place for the collected data. Despite having a few processes for data governance and data ownership, there are some ambiguities in this regard, but the organization is applying gradual improvement to its data governance practices.

The table below shows the desirability values of each criterion for Company C1:

Perspective	Criteria	Level number	Level Definition
Technology/ Data	Technology Infrastructure and Integration	Level 4	High level of integration
	Data Distribution and Accessibility	Level 4	70% of required data is accessible when and where needed within an organization
	Data Collection Robustness	Level 4	The data collection methods provide ready to use data that is comprehensive and reliable
	Data Metrics Clarity	Level 3	The data metrics definitions are fully organized and provide fully usable data which requires some elaboration
	Data Analytics Capabilities	Level 2	Few departments use data analytics for limited operational decision making
Organization	Process Robustness	Level 3	The processes are developed based on initial customer needs but are not flexible enough to fulfill new customer needs in the shortest time
	Organizational Structure	Level 4	All departments of the organization are structured based on customer needs
	Cultural Strength	Level 4	The culture of the organization is driven by the needs and voices of customers
	Strategy Focus	Level 2	The organization strategy includes some sections for moving toward a customer-centric approach
	Staff Expertise	Level 3	The employees know the customer needs and can take action to fulfill them

	Leadership Support	Level 4	Organization leadership support a customer-centric organization and take action to improve it
	Financial	Level 5	Organization was exponentially profitable during the last five years
Customer	Awareness and Training	Level 4	Customer is familiar with the company and most products or services
	Satisfaction	Level 3	customer is loyal to products and services and keeps referring other customers to the company
	Expectation	Level 2	The products and services do match with some of the customers' needs but require many changes
	Loyalty and commitment	Level 3	customer is going to purchase again even if the offering of other companies are same or even better
Policy	Data Privacy Compliance	Level 3	The data management practices in the organization are fully designed in compliance with local, regional and global customer information privacy requirements
	Data Security Compliance	Level 3	The data management practices in the organization are fully designed in compliance with local, regional and global customer information security requirements
	Data Ownership	Level 2	The data ownership is to some degree assigned to particular people, roles, departments
	Data Governance	Level 2	The organization follows some data governance practices which are informally communicated with departments

Table 61: Customer Centricity Assessment Results - Company C1

Company C2

The second company of Case Study 2 is a public company in the food and beverage industry. This is a fast-growing company with stores in different United States cities. They also have multiple e-commerce retailer websites which offer the products of this company.

From the technology perspective, there has been a huge recent investment in data infrastructure, data warehousing, and data analytics which has improved the underlying systems that internal teams are using to make better decisions.

From the Organization's perspective, this company has a unique, well-established, and cohesive culture that enables them to collaborate internally and also serve the customers beyond their expectations. There are some gaps in the strategic alignment of departments due to a lack of strategic focus. The employees are highly trained, and there is a huge emphasis on the education of new employees to serve the customers. Leadership supports new customer-oriented initiatives and has been profitable during the last five years.

From the Customer perspective, this organization has very loyal customers who return for new products frequently. The new mobile application enables the customers to be informed of the most recent products. The loyalty programs and campaigns have launched frequently, which in most cases have a very high success rate.

From the Policy perspective, the company follows multiple data privacy and security and has established processes to protect the data collected from customers and employees. There are some gaps in data governance practices that require the organization to take more steps to clarify the processes and ownership of systems, data, and applications.

Perspective	Criteria	Level number	Level Definition
Technology/ Data	Technology Infrastructure and Integration	Level 4	High level of integration
	Data Distribution and Accessibility	Level 4	70% of required data is accessible when and where needed within an organization
	Data Collection Robustness	Level 4	The data collection methods provide ready to use data that is comprehensive and reliable
	Data Metrics Clarity	Level 3	The data metrics definitions are fully organized and provide fully usable data which requires some elaboration
	Data Analytics Capabilities	Level 2	Few departments use data analytics for limited operational decision making
Organization	Process Robustness	Level 3	The processes are developed based on initial customer needs but are not flexible enough to fulfill new customer needs in the shortest time
	Organizational Structure	Level 4	All departments of the organization is structured based on customer needs
	Cultural Strength	Level 4	The culture of the organization is driven by the needs and voices of customers
	Strategy Focus	Level 2	The organization strategy includes some sections for moving toward a customer-centric approach
	Staff Expertise	Level 3	The employees know the customer needs and can take action to fulfill them

	Leadership Support	Level 4	Organization leadership support a customer-centric organization and take action to improve it
	Financial	Level 5	Organization was exponentially profitable during the last five years
Customer	Awareness and Training	Level 4	Customer is familiar with the company and most products or services
	Satisfaction	Level 3	customer is loyal to products and services and keeps referring other customers to the company
	Expectation	Level 2	The products and services do match with some of the customers' needs but require many changes
	Loyalty and commitment	Level 3	customer is going to purchase again even if the offering of other companies are same or even better
Policy	Data Privacy Compliance	Level 3	The data management practices in the organization are fully designed in compliance with local, regional and global customer information privacy requirements
	Data Security Compliance	Level 3	The data management practices in the organization are fully designed in compliance with local, regional and global customer information security requirements
	Data Ownership	Level 2	The data ownership is to some degree assigned to particular people, roles, departments
	Data Governance	Level 2	The organization follows some data governance practices which are informally communicated with departments

Table 62: Customer Centricity Assessment Results - Company C2

The Customer-Centricity Approach for companies in the case study is calculated through the following formula (see Chapter four for more details)

$$S_{CC} = \sum_{i=1}^{m} \sum_{j=1}^{n} (P_j)(C_{i,j})(D_{i,j})$$

Where

S_{CC} is the Customer-centricity Score

P_j is the relative value of perspective j with respect to Customer-centricity Score

$$where\ j = 1,2, \dots, n$$

$C_{i,j}$ is the relative value of criteria i under perspective j with respect to Customer-centricity Score

$$where\ j = 1,2, \dots, n\ \ AND\ i = 1,2, \dots, m$$

$D_{i,j}$ is the Desirability value of criteria i under perspective j

$$where\ j = 1,2, \dots, n\ \ AND\ i = 1,2, \dots, m$$

The tables below present the detailed values for Perspectives, Criteria and Desirability, and customer-centricity score for each company in case study 2.

Company C1 Customer-centricity Score Calculations

Perspective	Criteria	Global Weights (GW)	Level number	Desirability Value (DV)	GW X DV
Technology/ Data	Technology Infrastructure and Integration	5.13%	Level 3	49.00%	2.51%
	Data Distribution and Accessibility	3.80%	Level 3	47.00%	1.79%
	Data Collection Robustness	2.66%	Level 2	30.00%	0.80%
	Data Metrics Clarity	2.66%	Level 2	38.00%	1.01%
	Data Analytics Capabilities	4.56%	Level 3	59.00%	2.69%
Organization	Process Robustness	2.97%	Level 3	62.00%	1.84%
	Organizational Structure	2.70%	Level 3	72.00%	1.94%
	Cultural Strength	4.86%	Level 3	69.00%	3.35%
	Strategy Focus	4.05%	Level 2	31.00%	1.26%
	Staff Expertise	3.78%	Level 2	28.00%	1.06%
	Leadership Support	5.40%	Level 4	83.00%	4.48%
	Financial	3.51%	Level 2	34.00%	1.19%

Customer	Awareness and Training	5.28%	Level 2	30.00%	1.58%
	Satisfaction	11.55%	Level 2	43.00%	4.97%
	Expectation	10.23%	Level 1	20.00%	2.05%
	Loyalty and commitment	6.27%	Level 2	38.00%	2.38%
Policy	Data Privacy Compliance	5.22%	Level 2	44.00%	2.30%
	Data Security Compliance	5.76%	Level 3	100.00%	5.76%
	Data Ownership	3.24%	Level 2	45.00%	1.46%
	Data Governance	3.78%	Level 2	21.00%	0.79%
				Customer Centricity Score	45.2%

Table 63: Company C1 Customer-centricity Score Calculations

Company C2 Customer-centricity Score Calculations

Perspective	Criteria	Global Weights (GW)	Level number	Desirability Value (DV)	GW X DV
Technology/ Data	Technology Infrastructure and Integration	5.13%	Level 4	80.00%	4.10%
	Data Distribution and Accessibility	3.80%	Level 4	68.00%	2.58%
	Data Collection Robustness	2.66%	Level 4	100.00%	2.66%
	Data Metrics Clarity	2.66%	Level 3	72.00%	1.92%
	Data Analytics Capabilities	4.56%	Level 2	30.00%	1.37%
Organization	Process Robustness	2.97%	Level 3	62.00%	1.84%
	Organizational Structure	2.70%	Level 4	95.00%	2.57%
	Cultural Strength	4.86%	Level 4	88.00%	4.28%
	Strategy Focus	4.05%	Level 2	31.00%	1.26%
	Staff Expertise	3.78%	Level 3	68.00%	2.57%

	Leadership Support	5.40%	Level 4	83.00%	4.48%
	Financial	3.51%	Level 5	100.00%	3.51%
Customer	Awareness and Training	5.28%	Level 4	75.00%	3.96%
	Satisfaction	11.55%	Level 3	100.00%	11.55%
	Expectation	10.23%	Level 2	51.00%	5.22%
	Loyalty and commitment	6.27%	Level 3	99.00%	6.21%
Policy	Data Privacy Compliance	5.22%	Level 3	99.00%	5.17%
	Data Security Compliance	5.76%	Level 3	100.00%	5.76%
	Data Ownership	3.24%	Level 2	45.00%	1.46%
	Data Governance	3.78%	Level 2	21.00%	0.79%
				Customer Centricity Score	73.2%

Table 64: Company C2 Customer-centricity Score Calculations

Score Improvement recommendations

In this section, the researcher provides recommendations to improve the customer-centricity approach in companies C1 and C2 according to the calculated customer-centricity scores.

The case study analysis on three hypothetical companies shows that the customer-centricity score of companies C1 and C2 are 45.2% and 73.2%, respectively. For both companies, there are many opportunities to improve customer-centricity. In the following section, a few of the gaps and improvement opportunities are discussed for each company separately.

Company C1

Company C1 got the lowest score in Data Collection robustness and Data Governance criteria. The organization needs to cover the gaps in data collection methods and design solid processes for data collection, which impacts directly on the metrics clarity and data analytics criteria and would pull those scores up as well. In addition, the practices and procedures for data governance need to be revised and upgraded since it impacts the data ownership and data privacy at this organization.

For improving the scores under the Organization perspective, the company needs to address two main issues. The focus of the strategy efforts needs to be on customer-centric initiatives, and also, the employees need to be trained in regard to customer relationship management. Overall, since the company is benefiting from the leadership support from customer-oriented approaches, the strategy focus change can be managed smoother.

Finally, Company C1 needs to invest more in customer awareness and training since it directly impacts the expectations and loyalty of current and future customers.

Company C2

Company C2 got the lowest scores in Data Governance and strategy focus criteria. This organization can improve its customer centricity score easily by consolidating the strategy focuses. Although customer-centricity is one of the main drivers of the strategy in this company, the strategy needs to be more focused on processes and products that directly impact customers.

The Data Governance gap needs to be covered by need processes, measures, and monitoring applications. Regarding the scale of this organization, automation of data governance practices and processes is required to improve this score. In other words, besides clarity of the processes, the supporting applications and systems for data governance play an important role in improving the score in this criterion.

Despite having a robust infrastructure for data collection, data analytics requires more efforts to turn data into insights. There are huge data sources that can be utilized for decision-making inside the organization that is not fully exploited.

Finally, there are some opportunities to meet the customer expectations in regards to new trends of food and beverages dietary offerings, which can improve the products of this company.

Research Validity

To ensure the validity of the research and to follow previous Ph.D. dissertations[218][279][224][222], three aspects of validity are considered while conducting the research: Content validity, Construct validity, and Criterion validity.

Content validity is the first aspect of research validity and needs to be considered in the entire process of the research. To validate the content of this research, expert panels were formed during this research to ensure the perspectives and criteria identified from the literature are valid and relevant to the purpose pursued in this research. Also, the experts were provided with the opportunity of expanding the content by suggesting new factors (perspectives or criteria) and improving the content validity of this research. Through this process, a new criterion was identified (financial) and added to the relevant content pertaining to this research topic.

Construct validity evaluates the capability and fitness of the developed model to deal with the topic of the research. During this research, many subject matter experts, academic faculty, and doctoral students provided feedback and recommendation in regard to the model developed throughout this research to validate the construct of this research. The final construct was validated through disagreement analysis which ensures the model doesn't have wide differences in opinions from a diverse group of experts.

Criterion validity during and after analysis of the results of the research. In this research, multiple academic faculty and SMEs were involved in providing feedback on the accuracy of the outcomes of this research and validating the results and

recommendations suggested in this research. Besides, Hypothetical companies were created during the case study analysis of this research to test the model.

Chapter Seven: Contribution and future studies

Research outcomes and contribution

There are multiple expected contributions and results from this research. The first and foremost purpose of this research is to develop a model for evaluating an organization's degree of maturity concerning the customer-centricity approach. This model includes attributes that are identified through literature review and expert inputs and relative impact on the ultimate objective of this model. From the academic perspective, this research's contribution is in fulfilling the research gap found during the initial literature review by developing a multi-criteria-based measuring approach for evaluating the customer-centricity approach. On the other hand, this model assists organizations with self-assessment and continuous improvement in their customer-centric initiatives from a business and practical perspective. Finally, this research also recommends improvements that can facilitate the transition from product-centric to customer-centric.

This research is defined based on the gaps that were identified during the literature review. There is a lack of knowledge in quantifying the customer-centricity of an organization through maturity levels and developing a model to provide a guideline to drive an organization from a product-centric approach to a customer-centric approach.

This research contributes to the technology management body of knowledge by covering this gap and proposing a novel quantitative method to assess an organization's maturity level in customer-centricity.

Besides, this research improves our perception of this discipline and highlights the dynamics of the internal and external factors impacting customer orientation projects in technology management academic research.

The final model that is developed and applied in this study is a situational awareness tool. Improvement of an organization's Customer orientation is not achieved directly through the model application but is instead enabled by it. Directing the company toward a customer-centric organization is not possible without having enough visibility toward where they are standing and assessing the current state of the organization, and a valuable instrument that organizational change leaders can use to effectively understand the internal and external dynamics surrounding customer-centricity is maturity model

This research enables the evaluation of the maturity level of customer orientation in an organization. It allows the organization's leaders to have a thorough understanding of the organization's current state. On the other hand, the gaps revealed in this process empower the change management team in the organization to build a long-term roadmap to develop and improve the required capabilities

The other contribution of this research to the industry is the criteria and metrics that quantify the maturity level of the organization regarding Customer-centricity. Quantification of the organization's current state with specific metrics develops a

common understanding of where the organization is standing in regard to customer-centricity and equips the change management team with an instrument to communicate the current state, gap, future state, and progression of the change management project.

On the practical and business level, the outcome of this research offers a quantitative tool and step-by-step framework for evaluating the organizational maturity levels and recommendations of the improvements to develop new capabilities

The methodological foundations of this research are based on two primary methodologies of HDM and Action Research. The expert's practical inputs collected through Expert input and the literature review balanced and adjusted the final HDM model from two theoretical/academic perspectives and industry/practical standpoints.

There is a lack of knowledge in quantifying the organization's customer-centricity through maturity levels and developing a model to guide an organization from a product-centric approach to a customer-centric approach.

This research contributes to the Maturity Model literature by covering this gap and proposing a novel quantitative method to assess an organization's maturity level in customer-centricity.

On the practical and business level, this research's outcomes offer a quantitative tool and step-by-step framework for evaluating the organizational maturity levels and recommendations of the improvements to develop new capabilities.

The research was structured based on four main research questions that during the last chapters, comprehensive and exhaustive responses are provided. However, the research question responses can be summarized in the following concise answers:

RQ1: What are the highest priorities of challenges, gaps & barriers to adopt and implement customer-centric approaches in a product-centric organization?

In this research and dissertation, the main challenges and gaps in customer-centricity in organizations are identified, and critical success factors to overcome those barriers were introduced.

RQ2: What are the dynamics among perspectives and criteria impacting an organization's maturity in customer-centricity approaches?

The dynamics among impacting factors on customer-centricity are modeled and quantified through developing a hierarchical decision model which formulates outcomes of this research into a reusable resource for future academic research as well as industry practices

RQ3: Is the proposed maturity model appropriate for the assessment of the customer-centricity approach in the organization?

The proposed maturity model was validated through expert panel judgment, case study analysis, and sensitivity analysis which reveal that the model is appropriate for the assessment of the customer-centricity approach.

RQ4: Is the model generalizable to other industries and applications?

The focus of this research was on the e-commerce industry, which is heavily impacted by customer-centric approaches. However, the results of this research can be applied and generalized in other industries and applications

As the Literature review reveals [84], there is little research and documentation on how to develop maturity models that are widely accepted, tangible and sustainable [84]. In most academic literature, researchers focus on one or a few areas to develop the maturity model. There is inconsistency in the methods used and limited to the researcher's experience in a particular field, and an exhaustive list of criteria was limited to the industry and sector that was studied.

This research is developed based on the HDM methodology, which is widely used to build decision models in academia and industry and explores its application in building maturity models to evaluate its customer-centricity. This is a novel employment of this method in assessing customer orientation capability which has no precedence and will further reveal the strength and fit-for-use of the HDM model for a myriad of applications and use cases. The researcher believes this research also

promotes this methodology's utilization and adoption across academia and industry. In other words, the ultimate goal of this research which is “To develop a quantitative multi-dimensional model to evaluate the maturity of the organization in customer-centricity approach,” is completely fulfilled.

Research limitation

The authors identified three limitations in this research, which is also an opportunity for future studies in this field.

The research case study is limited to E-commerce companies. However, the model can be expanded to other digital businesses such as online video conferencing and chat services, AI-driven digital assistants, or social media advertising platforms.

The model is developed based on the experts' subjective judgment, which is heavily impacted by their biases and level of knowledge in this field. In order to mitigate such impact, the experts need to be selected from more impartial and knowledgeable people.

The criteria weight in the model will change over time, and new perspectives and criteria may need to be considered as new technologies and policies are introduced every day. Therefore, to gain the most benefit from the proposed model, review and revision may be needed after a specific period.

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Appendix A: Expert Panel formation and correspondence

The Experts were selected from a diverse and relevant field of work and study. The following tables show the size and background of the experts in the panel.

Size	Funnel stage
128	Experts **Selected** in the initial stage
79	Experts **Contacted** based on their experience and background
9	Either **Declined** or informally accepted but didn't participate in research
41	Contacted for the data collection
28	Experts actively **Participated** in research

Table 65: Number of Experts

Expertise or Titles
VP/Director - Sales, Marketing, IT
System Analysts and Architects
Data Management and Governance Experts
Business Development Professionals
Project & Product Managers

Table 66: Expertise or Titles of Experts

Organizations
Facebook, Amazon, Deloitte, Intel, Paytronix, ADI, Daimler Trucks NA, CDK Global, Dutch Bros Coffee, MTI, PSU, Biotronics, …

Table 67: Expert Organzations

The experts were contacted through emails which are outlined below:

Email 1 – Initial Invitation to Experts

Title: Invitation to be an expert in Soheil Zarrin's Ph.D. research

Body:

Dear Subject Matter Expert,

Thank you for accepting to be on my expert panel.

Please fill out the form below and return it to me at your earliest convenience.

Full name:

Organization:

Position:

I would also appreciate it significantly if you could suggest other experts who have expertise or experience in customer-centricity approach or retail e-commerce practices as potential expert panel members. Please fill the fields below in case you wish to suggest other experts participate in this study:

Name: …….. Email: ……..

Name: …….. Email: ……..

Name: …….. Email: ……..

About this research:

I am a Ph.D. candidate in the Department of Engineering and Technology Management (ETM) at Portland State University (PSU). I am conducting research on Customer-centricity, and its title is "Maturity Model for Customer-Centric Approach in Enterprise: The Case of E-Commerce and Online Retail Industry."

I am building a multi-criteria decision model to develop a customer-centricity score to measure the organization's resources and capabilities in a customer-centric approach.

In order to properly build the model, I will use subject matter experts' (SME's) judgments for validation and quantification purposes.

I am hereby inviting you to participate in this study by being one of the SME's that will help me with the model validation and quantification. Your background and expertise will be very helpful to my research.

If you accept the invitation, you will receive online survey instruments, which will be used to collect your judgments. Below is a summary of the participation regarding time commitment:

• *Validation Phase: a maximum of 2 online surveys, ranging from 2 to 5 minutes each*

• *Quantification Phase: a maximum of 3 online surveys, ranging from 5 to 15 minutes each*

Desirability Curves: a survey ranging from 10-15

Please be informed that:

• *Experts are going to be involved based on their experience and background. Therefore, experts are NOT going to be participating in all surveys.*

• *The time period between each survey will range from a few days up to several weeks, depending on how quickly other experts respond.*

Research Summary:

The network technologies are changing the dynamics of the interaction between customer and provider. Customers demand closer relationships and higher investment between partners, as well as cooperation between companies to build supporting technologies for their unique needs. Customer-centricity is defined as interaction with the customer through various touchpoints and aggregating these relations to create a position for the customer. Each customer has a different need and expectation from the provider or seller, and companies need to be flexible enough to fulfill their needs.

One of the reasons organizations invest less in customer experience is that they believe they are already customer-centric organizations.

Companies need to deploy structured methods to evaluate their customer-centricity as it is now to achieve this purpose. Also, the techniques should enable them to plan the organization's evolution toward the customer-centric approach strategically. This research focuses on designing a new maturity model to evaluate and plan an organization's customer-centricity. The hierarchical Decision Model (HDM) will be used as the primary methodology to quantify impacting factors and intensity of influence on the ultimate outcome.

Please notice that the Portland State University's Institutional Review Board (IRB) has approved this study. Participation in this study does not involve any risks of any kind whatsoever. Moreover, your name will be kept in total confidentiality and will not be used in any published reports.

All the best,

Soheil Zarrin - PhD Candidate

Department of Engineering and Technology Management (ETM)

Portland State University (PSU)

Phone: (971) 325-7537

Email: szarrin@pdx.edu

Email 2 – Perspectives Validation

Title: Customer-Centricity Research - Step 1: Perspective validation

Body:

Dear Expert,

Thank you for accepting to participate in my research.

Note:

You don't need to go through this section if you are familiar with the purpose and process of this research

What do we want to achieve?

In simple words, the ultimate goal of this research is to find the factors that impact customer-centricity and then quantify them.

To make sure that we identified the right factors, we group factors under Perspectives to make them easier to work with.

The attached file shows the initial model that includes goal (top-level), Perspective (level 2), Criteria (Level 3), and Outcome (bottom level)

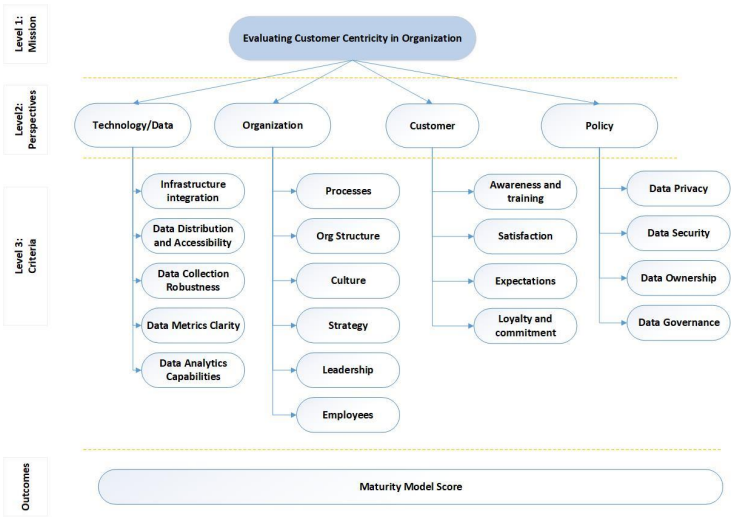

Figure 51: Initial Model Shared with Experts

What are the steps?

In this research, we are going to have a few steps in data collection which are interdependent.

In summary, below lists the steps that you contribute to this research:

Step 1: Validate the Perspectives (Do these perspectives have a significant impact on customer-centricity? Are there more?)

Step 2: Validate the Criteria - a.k.a. factors (Do these factors have a significant impact on customer-centricity? Are there more?)

Step 3 Quantify the Perspectives and Criteria (How much do they impact customer-centricity?)

Step 4: Validate and quantify the desirability curves (I'll go through it later!)

(If the words sound unfamiliar, no worries, I promise they're more understandable than what they look like!!)

Let's start!

Step 1:

At this point, I ask you to help me validate the perspectives that contribute to customer-centricity in an organization. The preliminary perspectives have been identified in the literature and are listed on the survey instrument that I am sending herein.

Please click on the following link to access the survey instrument. (less than 5 minutes)

https://portlandstate.qualtrics.com/jfe/form/SV_07I2oSmEqZbgjvE

You will see the instructions to submit your response after you click on the link.

I would appreciate it if you fill out the survey before the end of the day Thursday, 7/22/2021. Subsequent steps will be sent later in other emails. Thanks again!

All the best,

Soheil Zarrin - PhD Candidate

Department of Engineering and Technology Management (ETM)

Portland State University (PSU)

Phone: (971) 325-7537

Email: szarrin@pdx.edu

Email 3 – Thank you notes – step 1

Title: Step 1 Results received -- Thank you!

Body:

Dear Subject Matter Expert,

Thank you for your input. I received your input for Step 1 of the customer-centricity research.

In a few days, the Step 2 survey will be sent to you. Appreciate your participation in this research.

Have a great day.

All the best,

Soheil Zarrin - PhD Candidate

Department of Engineering and Technology Management (ETM)

Portland State University (PSU)

Phone: (971) 325-7537

Email: szarrin@pdx.edu

Email 4 - Criteria Validation

Title: Customer-Centricity Research - Step 2: Criteria Validation

Body:

If this is your 1st survey, no worries, each step is designed independent from each others, and you can respond to this survey without going through step #1.

Dear Expert,

The research in step #1 was a complete success. I got a more than expected survey returned with informative comments and notes.

It was amazing participation, and I appreciate your involvement in this research so much!

STEP 2:

In step #2, we will dive deeper into impacting factors on Customer-centricity.

The perspectives are broken down into more granular criteria.

Please click on the following link to access the survey instrument. (between 10-15 minutes)

Step #2 Survey:

https://portlandstate.qualtrics.com/jfe/form/SV_dptNs7psbbW1kbk

You will see the instructions to submit your response after you click on the link.

I would appreciate it if you fill out the survey before the end of the day Thursday 8/12/2021. Subsequent steps will be sent later in other emails. Thanks again!

Note:

You don't need to go through this section if you are familiar with the purpose and process of this research

What do we want to achieve?

In simple words, the ultimate goal of this research is to find the factors that impact customer-centricity and then quantify them.

To make sure that we identified the right factors, we group factors under Perspectives to make them easier to work with.

The attached file shows the initial model that includes goal (top-level), Perspective (level 2), Criteria (Level 3), and Outcome (bottom level)

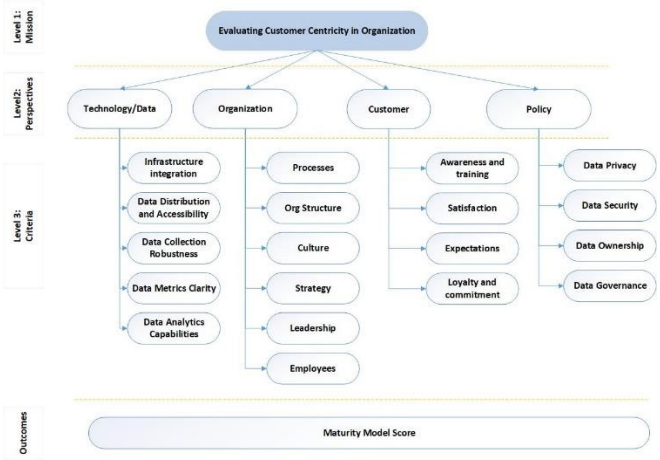

Figure 52: Initial Model Shared with Experts

What are the steps?

In this research, we are going to have a few steps in data collection which are interdependent.

In summary, below lists the steps that you contribute to this research:

Step 1: Validate the Perspectives (Do these perspectives have a significant impact on customer-centricity? Are there more?)

Step 2: Validate the Criteria - a.k.a. factors (Do these factors have a significant impact on customer-centricity? Are there more?)

Step 3 Quantify the Perspectives and Criteria (How much do they impact customer-centricity?)

Step 4: Validate and quantify the desirability curves (I'll go through it later!)

(If the words sound unfamiliar, no worries, I promise they're more understandable than what they look like!!)

Please feel free to reach out if you have any questions.

All the best,

Soheil Zarrin - PhD Candidate

Department of Engineering and Technology Management (ETM)

Portland State University (PSU)

Phone: (971) 325-7537

Email: szarrin@pdx.edu

Email 5 – Thank you notes – step 2

Title: Step 2 Results received -- Thank you!

Body:

Dear Subject Matter Expert,

Thank you for your input. I received your input for Step 2 of the customer-centricity research.

In a few days, the Step 3 survey will be sent to you. Appreciate your participation in this research.

Have a great day.

All the best,

Soheil Zarrin - PhD Candidate

Department of Engineering and Technology Management (ETM)

Portland State University (PSU)

Phone: (971) 325-7537

Email: szarrin@pdx.edu

Email 6 – Quantification – Leadership and organization Panels

Title Customer-Centricity Research - Step 3-LC: Factors Quantification - Leadership Cohort

Body

Dear Subject Matter Expert,

Thank you again for participating in this research.

In this step, the factors are compared pairwise. In other words, each factor is compared with other factors in the same group.
With the information collected from this step, the researcher determines the relative impact/importance of each factor on Customer-centricity .

Start Step 3:

Please click on the link below to start your input.

Link 1) Comparison of Perspective (estimated time: 3-5 minutes)

http://research1.etm.pdx.edu/hdm2/expert.aspx?id=d0e02f67c7db1d6e/e7086497be33e145!A01

Link 2) Comparison of Organization Criteria (estimated time: 7-10 minutes)

http://research1.etm.pdx.edu/hdm2/expert.aspx?id=d0e02f67c7db1d6e/e7086497be33e145!B02

Please feel free to reach out if you have any questions.

I would appreciate it if you fill out the survey before the end of the day Thursday, 9/2/2021. Subsequent steps will be sent later in other emails. Thanks again!

All the best,

Soheil Zarrin - PhD Candidate

Department of Engineering and Technology Management (ETM)

Portland State University (PSU)

Phone: (971) 325-7537

Email: szarrin@pdx.edu

NOTE: The application used in this step is user-friendly, and the below details provide additional directions in case needed. Skip the below section if you feel you don't need it.

More details about ETM HDM Software:

After clicking on the link(s) provided above, you will be guided to the HDM model on the PSU website (pdx.edu)

I use ETM HDM software (Engineering and Technology Management Hierarchical Decision Model Software) to quantify the impact of each factor on the ultimate goal (i.e., Customer-Centricity Level)

Here is what you should expect in the ETM HDM software:

1) Enter your name and click on “Submit.”

2) On the new page, select the node that is assigned to you (in the example below “Technology”)

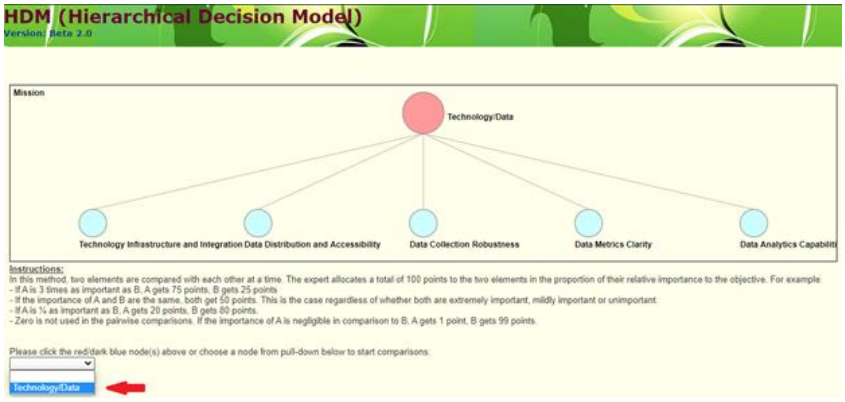

Figure 53: HDM Example Shared with Experts

3) Move the **slider** to left and right or enter the numbers in the **box** beside each factor) to input your judgment. Continue this for all sliders on the screen.

Example:

(“A” is Data Distribution and Accessibility; “B” is Technology Infrastructure and Integration)

- If “A” is three times as important as “B,” “A” gets 75 points, “B” gets 25 points

- If the importance of “A” and “B” are the same, both get 50 points.

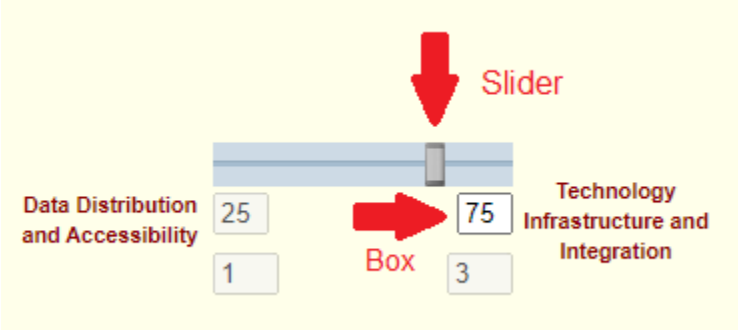

Figure 54: Scoring How-to Shared with Experts

4) Click on "Save and Go to the Main Page" when you enter values for each slider.

   (If you don't see the button, scroll down a little bit)

5) Click on "Submit" on the main page, and it's done!

Email 7 – Quantification – Technology and Policy Panels

Title Customer-Centricity Research - Step 3-TC: Factors Quantification - Technology Cohort

Body

Dear Subject Matter Expert,

Thank you again for participating in this research.

In this step, the factors are compared pairwise. In other words, each factor is compared with other factors in the same group.

With the information collected from this step, the researcher determines the relative impact/importance of each factor on Customer-centricity .

Start Step 3:

Please click on the link below to start your input.

Link 1) Comparison of Technology/Data Criteria (estimated time: 5-7 minutes)

http://research1.etm.pdx.edu/hdm2/expert.aspx?id=d0e02f67c7db1d6e/e7086497be33e145!B01

Link 2) Comparison of Policy Criteria (estimated time: 3-5 minutes)

http://research1.etm.pdx.edu/hdm2/expert.aspx?id=d0e02f67c7db1d6e/e7086497be33e145!B04

Please feel free to reach out if you have any questions.

I would appreciate it if you fill out the survey before the end of the day Thursday, 9/2/2021. Subsequent steps will be sent later in other emails. Thanks!

All the best,

Soheil Zarrin - PhD Candidate

Department of Engineering and Technology Management (ETM)

Portland State University (PSU)

Phone: (971) 325-7537

Email: szarrin@pdx.edu

Email 8 – Quantification – Sales and Marketing Panels

Title: Customer-Centricity Research - Step 3-SMC: Factors Quantification - Sales & Marketing Cohort

Body:

Dear Subject Matter Expert,

Thank you again for participating in this research.

In this step, the factors are compared pairwise. In other words, each factor is compared with other factors in the same group.

With the information collected from this step, the researcher determines the relative impact/importance of each factor on Customer-centricity .

Start Step 3:

Please click on the links below to start your input.

Link 1) Comparison of Customer Criteria (estimated time: 3-5 minutes)

http://research1.etm.pdx.edu/hdm2/expert.aspx?id=d0e02f67c7db1d6e/e7086497be33e145!B03

Link 2) Comparison of Organization Criteria (estimated time: 7-10 minutes)

http://research1.etm.pdx.edu/hdm2/expert.aspx?id=d0e02f67c7db1d6e/e7086497be33e145!B02

Please feel free to reach out if you have any questions.

I would appreciate it if you could fill out the survey before the end of the day Thursday, 9/2/2021. Subsequent steps will be sent later in other emails. Thanks again!

All the best,

Soheil Zarrin - PhD Candidate

Department of Engineering and Technology Management (ETM)

Portland State University (PSU)

Phone: (971) 325-7537

Email: szarrin@pdx.edu

Email 9 - Desirability Curve

Title: Customer-Centricity Research - Step 4 (Final Step)

Body

Dear Subject Matter Expert,

Thank you again for participating in this research. This survey is the last survey in this research which is sent to a very limited group of Experts with a high impact in the previous steps.

In this last step, The SMEs help to create a Desirability Curve for the perspectives and criteria.

Start Step 4:

Note: Before moving forward with the Survey, It's highly recommended to spend 3 minutes reading about Desirability Curves in the below section.

Please click on the links below to start your input.

Quantify Desirability Curve Survey: (21 questions; estimated time: 15-25 minutes)

https://portlandstate.qualtrics.com/jfe/form/SV_cMFcrRcAosMwNw2

Please feel free to reach out if you have any questions.

I would appreciate it if you could fill out the survey before the end of the day Thursday, 9/30/2021. Subsequent steps will be sent later in other emails. Thanks again!

What is a Desirability Curve?

Desirability Curves tell us from experts' perspective how much each factor is desirable in the model (and have an impact on the outcome). Desirability is a score between 0-100 that you give to each factor (and levels defined within).

Example for Desirability Curve

If we define "Customer Awareness" in 5 levels and assign desirability scores as follows:

Awareness and Training	Desirability
Level 1: Customer has not heard of any products or services of the company	0
Level 2: Customer has heard the name of the company but not products or services	20
Level 3: Customer is familiar with the company and few products or services	50
Level 4: Customer is familiar with the company and most products or services	80

Level 5: Customer is familiar with the company and has got training on how to use products or services	100

Table 68: Disirability Curve levels example

We can build the below desirability curve for Awareness and Training criteria:

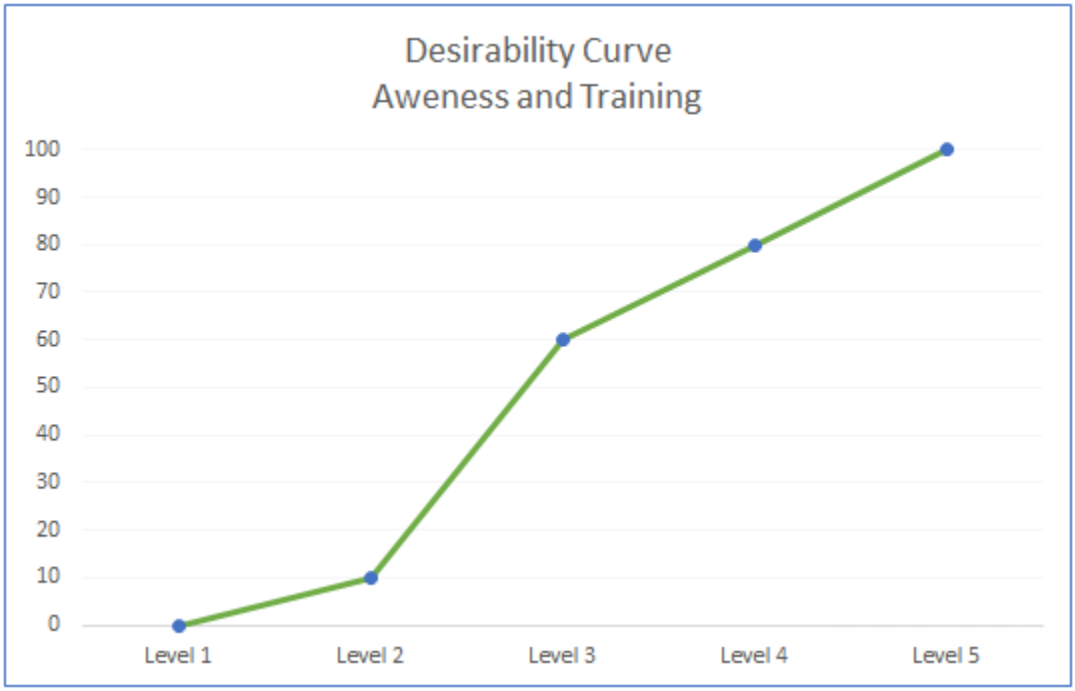

Figure 55: Desirability Curve Example

These curves help the researcher to build the final Hierarchical Decision Model and, for my research, the Customer-centricity Score.

Please feel free to reach out if you need further information about the model or the request in this step. Thank you again!!

All the best,

Soheil Zarrin - PhD Candidate

Department of Engineering and Technology Management (ETM)

Portland State University (PSU)

Phone: (971) 325-7537

Email: szarrin@pdx.edu

Appendix B: Pilot implementation of the HDM model

The pseudo expert panel was formed with seven members that participated in the HDM pilot implementation in the following phases:

The research structure and design will be explained in further detail in the next sections. Initially, expert judgment is needed to validate the model in terms of perspectives and criteria. Then, the desirability curves metrics need to be validated and quantified by the experts. Finally, the experts need to quantify the model and pairwise compare the decision elements in the model.

Most parts of these judgments (Validation/Quantification) are done using MS Excel tool, and the HDM model quantification is implemented using the ETM HDM model developed by the Engineering and Technology Management department at Portland State University.

In the next section, the details of activities for data collection and analysis is described

Reduced HDM model for Pilot implementation

The model is limited to 3 perspectives of Technology/Data, Organization, and customer for the HDM pilot in the Comprehensive Exam.

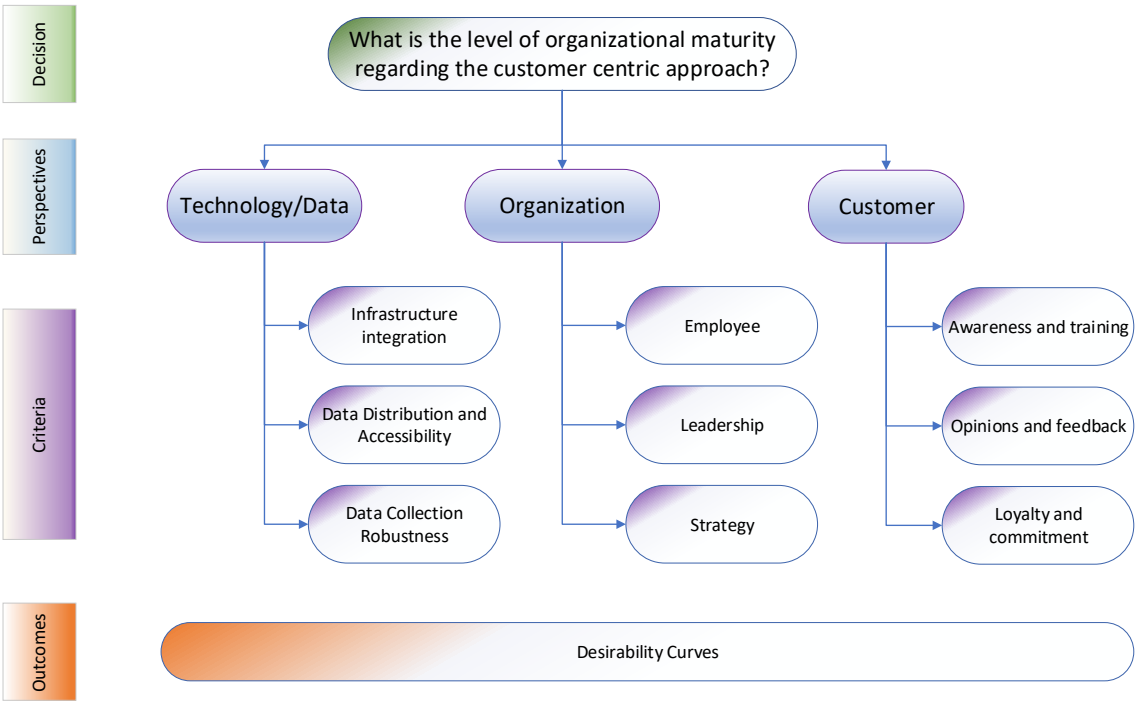

Figure 56: HDM Pilot Model

A. Validate the HDM Perspectives and Criteria

In order to validate the HDM Perspectives and Criteria, a spreadsheet was created and used to collect the data from Experts:

B. Quantification of HDM Criteria and Perspectives

In order to quantify the HDM Criteria and Perspectives, the HDM software, which was developed by the PSU ETM department, was utilized.

Below shows Mission/Perspective/Criteria View in this research software:

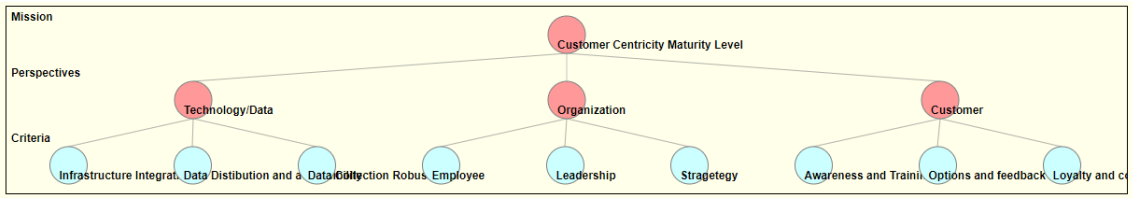

Figure 57: HDM Software Example

The link to this model was sent through email to the experts to perform a pair-wise comparison for the Perspectives and Criteria

C. Quantification of the desirability metrics

For the quantification of the Desirability levels in my HDM model, I created a spreadsheet to collect the responses of the Experts.

Desirability Charts Data Collection					
Infrastructure Integration	Level 1	Level 2	Level 3	Level 4	Level 5
	50%	70%	100%		
Data Distribution and accessibility	Level 1	Level 2	Level 3	Level 4	Level 5
	10%	20%	60%	80%	100%
Data Collection Robustness	Level 1	Level 2	Level 3	Level 4	Level 5
Employee		evel 2	Level 3	Level 4	Level 5
Leadership		evel 2	Level 3	Level 4	Level 5
Strategy	Level 1	Level 2	Level 3	Level 4	Level 5
Awareness and Training	Level 1	Level 2	Level 3	Level 4	Level 5
Satisfaction	Level 1	Level 2	Level 3	Level 4	Level 5
Loyalty and commitment	Level 1	Level 2	Level 3	Level 4	Level 5

10%
20%
30%
40%
50%
60%
70%
80%

Table 69: Data Collection Tool for Desirability Values

Perspectives, Criteria and Desirability curves definitions

HDM model variables and metrics

HDM Model goal/mission

The HDM model's goal is to evaluate and quantify the level of customer-centricity in an organization. The research is structured to answer the below question:

What is the level of organizational maturity regarding the customer-centric organization?

HDM Perspectives

Technology/Data Perspective

Enhance the performance of the technological and data solutions; This perspective measure the technology/data impact on customer-centricity

Criteria relevant to Technology/Data Perspective

Achieve a higher level of integration; There are different levels of integration for data and technology in an organization. This variable measures the level of integration for data and technologies. There are three levels of technological integration in an organization:

- Network integration which results in connectivity

- Data integration which results in data sharing
- Application integration results in interoperability of solutions

Accelerate data distribution and accessibility; This variable measures how much data is accessible in an organization and how soon the users can find the information they are looking for.

Enhance Data collection robustness; The data collection methods impact the data reliability, which directly influences the quality of decisions made in an organization. This variable measures the robustness of the data collection methods and if those methods ensure the data is comprehensive, relevant, and reliable.

Organization Perspective

Achieve organizational effectiveness and efficiency; This perspective measures how much an organization is effective and efficient in a customer-centric approach.

Criteria relevant to Organization Perspective

Identify employees' impact on customer-centricity; This variable measures the success of the employees in delivering customer-centric products and services.

Maximize leadership support; This variable measures how much the leadership of the organization supports the implementation of customer-centric approaches in the organization

Identify organizational strategy impact; This variable measures how much the organizational strategy aligns with the customer-centric organization.

Customer Perspective

Enhance customer experience; This perspective measures the customer perspective on customer-centric approach success in an organization.

Criteria relevant to Customer Perspective

Enhance customer awareness and training; This variable measures how much customers are familiar with the products and services of an organization to benefit the most from their offerings.

Achieve positive opinion and feedback of customer; This variable measures how positive the customer feedback is and how likely it is to recommend the organization and its products and services to others.

Achieve loyalty and commitment of customer; This variable measure how likely is the customer to return for new or further purchases.

In order to quantify the desirability of Criteria under **Technology** following levels and metrics are defined

Technology/Data	Infrastructure Integration
	Level 1: Network integration is implemented which resulted in hardware connectivity
	Level 2: Data Integration is implemented which resulted in improved data sharing
	Level 3: Application integration is implemented which resulted in interoperability of solutions
	Data Distribution and accessibility
	Level 1: Required data is not available at all
	Level 2: 30% of required data is accessible when and where needed within an organization
	Level 3: 50% of required data is accessible when and where needed within an organization
	Level 4: 70% of required data is accessible when and where needed within an organization
	Level 5: Required data is always accessible when and where needed within an organization
	Data Collection Robustness

	Level 1: The data collection methods are ineffective and don't provide reliable and usable data
	Level 2: The data collection methods are semi-structured and provide some usable data
	Level 3: The data collection methods are fully structured and provide fully usable data which requires data cleaning
	Level 4: The data collection methods provide ready to use data which is comprehensive and reliable

Table 70: Criteria under Technology for Pilot research

In order to quantify the desirability of Criteria under **Organization** following levels and metrics are defined

Organization	Employee
	Level 1: The employees are not familiar with customer needs
	Level 2: The employees are familiar with customer needs but can't take much action to fulfil them
	Level 3: The employees know the customer needs and can take action to fulfill them
	Level 4: The employees know the customer needs and are trained how to fulfil them
	Leadership
	Level 1: Organization leadership are not familiar with customer-centric organization
	Level 2: Organization leadership know about basics of customer organization but don't buy-in
	Level 3: Organization leadership know about customer-centric organization and support it
	Level 4: Organization leadership support customer-centric organization and take action to improve it
	Level 5: Organization leadership decision making is fully based on customer-centric approach
	Strategy

	Level 1: The organization strategy doesn't consider customer-centric approaches at all
	Level 2: The organization strategy includes some sections for moving toward customer-centric approach
	Level 3: Most of the organization strategy is designed with customer-centric approach in scope
	Level 4: The organization strategy is design with the core of customer-centric approach

Table 71: Criteria under Organization for Pilot research

In order to quantify the desirability of Criteria under **Customer** following levels and metrics are defined

Customer	Awareness and Training
	Level 1: Customer has not heard of the any products or services of company
	Level 2: Customer has heard the name of the company but not products or services
	Level 3: Customer is familiar with company and few products or services
	Level 4: Customer is familiar with company and most products or services
	Level 6: Customer is familiar with company and has got training on how to use products or services
	Satisfaction
	Level 1: customer is unhappy with products or services and spread negative word-of-mouth
	Level 2: customer is satisfied but unenthusiastic to recommend the product or services to others
	Level 3: customer is loyal to products and services and keep referring other customers to the company
	Loyalty and commitment

	Level 1: customer is never going to purchase the services or products again
	Level 2: customer is going to purchase again if there is no other competitive offerings in market
	Level 3: customer is going to purchase again even if the offering of other companies are same or even better

Table 72: Criteria under Customer for Pilot research

Expert Panel Correspondence

Dear Research Participant,

Thank you so much for your participation in advance.

This is pilot for the Comp Exam and it will be very quick and will take less than 5 minutes to complete.

The purpose of the model is to evaluate the level of customer orientation of an organization.

The Criteria used in this model are self-explanatory but you can also use the below definitions to understand the scope and definition of each criterion. Please feel free to contact me if you need further information.

Thank you in again.

All the Best,

Soheil

Link to HDM Model:

http://research1.etm.pdx.edu/HDM2/expert.aspx?id=d0e02f67c7db1d6e/f94b3e13b7943f14

HDM Perspectives

[Technology/Data]:

Enhance the performance of the technological and data solutions; This perspective measure the technology/data impact on customer-centricity

[Organization]:

Achieve organizational effectiveness and efficiency; This perspective measures how much an organization is effective and efficient in a customer-centric approach

[customer]:

Enhance customer experience; This perspective measures the customer perspective on customer-centric approach success in an organization.

HDM sub-criteria – Technology/Data

[Infrastructure Integration]:

Achieve a higher level of integration; There are different levels of integration for data and technology in an organization. This variable measures the level of integration for data and technologies. There are three levels of technological integration in an organization:

Network integration which results in connectivity

Data integration which results in data sharing

Application integration which results in interoperability of solutions

[Data Distribution and accessibility]:

Accelerate data distribution and accessibility; This variable measures how much data is accessible in an organization and how soon the users can find the information they are looking for.

[Data Collection Robustness]:

Enhance Data collection robustness; The data collection methods impact the data

reliability which directly influences the quality of decisions made in an organization. This variable measures the robustness of the data collection methods and if those methods ensure the data is comprehensive, relevant and reliable.

HDM sub-criteria – Organization

[Employee]:

Identify employees' impact on customer-centricity; This variable measures the success of the employees in delivering customer-centric products and services.

[Leadership]:

Maximize leadership support; This variable measures how much the leadership of the organization supports the implementation of customer-centric approaches in organization

[Strategy]:

Identify organizational strategy impact; This variable measures how much the organizational strategy aligns with the customer-centric organization.

HDM sub-criteria – Customer

[Awareness and Training]:

Enhance customer awareness and training; This variable measures how much customers are familiar with the products and services of an organization to benefit the most from their offerings.

[Options and feedback]:

Achieve positive opinion and feedback of customer; This variable measures how positive the customer feedback is and how likely is to recommend the organization and its products and services to others.

[Loyalty and commitment]:

Achieve loyalty and commitment of customers; This variable measures how likely is the customer to return for new or further purchases.

Please feel free to contact me if you have any questions or you need more information.

Thank you

All the Best,

Soheil Zarrin

Pilot HDM Implementation

The following section shows the results of the data collection and analysis

Perspective and Criteria Validation

All the 3 different perspective were validated by the experts with 100% agreeing that the perspectives were sufficient, and no changes were needed to be made.

Perspective	# of Experts	Validation Result	Validation percentage
Technology/Data	7	7/7	100%
Organization	7	7/7	100%
Customer	7	7/7	100%

Table 73: Collected Perspective Results in Pilot Research

Seven out of nine total Criteria were validated as important to consider in the customer-centricity assessment of an organization.

Criteria	# of Experts	Validation Result	Validation percentage
Infrastructure Integration	7	6/7	85%
Data Distribution and accessibility	7	7/7	100%

Data Collection Robustness	7	7/7	100%
Employee	7	7/7	100%
Leadership	7	7/7	100%
Strategy	7	7/7	100%
Awareness and Training	7	6/7	85%
Satisfaction	7	7/7	100%
Loyalty and commitment	7	7/7	100%

Table 74: Collected Criteria Results in Pilot Research

Desirability Curves

In this section, the experts quantified the desirability curve metrics. In other words, each metric for each criterion now has different quantified amount associated with

Infrastructure Integration
Level 1: Network integration is implemented which resulted in hardware connectivity
Level 2: Data Integration is implemented, which resulted in improved data sharing

Level 3: Application integration is implemented, which resulted in interoperability of solutions

Table 75: Desirability Levels for Infrastructure in Pilot Research

Data Distribution and accessibility
Level 1: Required data is not available at all
Level 2: 30% of required data is accessible when and where needed within an organization
Level 3: 50% of required data is accessible when and where needed within an organization
Level 4: 70% of required data is accessible when and where needed within an organization
Level 5: Required data is always accessible when and where needed within an organization

Table 76: Desirability Levels for Data Distribution in Pilot Research

Data Collection Robustness
Level 1: The data collection methods are ineffective and don't provide reliable and usable data
Level 2: The data collection methods are semi-structured and provide some usable data
Level 3: The data collection methods are fully structured and provide fully usable data, which requires data cleaning

Level 4: The data collection methods provide ready to use data that is comprehensive and reliable

Table 77: Desirability Levels for Data Collection in Pilot Research

Employee
Level 1: The employees are not familiar with customer needs
Level 2: The employees are familiar with customer needs but can't take many actions to fulfill them
Level 3: The employees know the customer needs and can take action to fulfill them
Level 4: The employees know the customer needs and are trained on how to fulfill them

Table 78: Desirability Levels for Employee in Pilot Research

Leadership
Level 1: Organization leadership are not familiar with a customer-centric organization
Level 2: Organization leadership know about the basics of customer organization but don't buy-in
Level 3: Organization leadership know about the customer-centric organization and support it

Level 4: Organization leadership support customer-centric organization and take action to improve it
Level 5: Organization leadership decision making is fully based on a customer-centric approach

Table 79: Desirability Levels for Leadership in Pilot Research

Strategy
Level 1: The organization strategy doesn't consider customer-centric approaches at all
Level 2: The organization strategy includes some sections for moving toward customer-centric approach
Level 3: Most of the organization strategy is designed with customer-centric approach in scope
Level 4: The organization strategy is designed with the core of the customer-centric approach

Table 80: Desirability Levels for Strategy in Pilot Research

Awareness and Training
Level 1: Customer has not heard of any products or services of company
Level 2: Customer has heard the name of the company but not products or services
Level 3: Customer is familiar with company and few products or services
Level 4: Customer is familiar with company and most products or services

Level 6: Customer is familiar with company and has got training on how to use products or services

Table 81: Desirability Levels for Awareness in Pilot Research

Satisfaction
Level 1: customer is unhappy with products or services and spread negative word-of-mouth
Level 2: customer is satisfied but unenthusiastic to recommend the product or services to others
Level 3: customer is loyal to products and services and keeps referring other customers to the company

Table 82: Desirability Levels for Satisfaction in Pilot Research

Loyalty and commitment
Level 1: customer is never going to purchase the services or products again
Level 2: customer is going to purchase again if there are no other competitive offerings in market
Level 3: customer is going to purchase again even if the offering of other companies are same or even better

Table 83: Desirability Levels for Loyalty in Pilot Research

Pilot HDM Implementation Results

The next part quantifies the criteria and perspectives based on the pairwise comparison done by the expert panel in the ETM HDM tool software. Each expert performed the pairwise comparisons between the perspective and then each of the underlying criteria for the respective perspective. The results were partly generated by ETM HDM software and partly by manual calculation in Microsoft Excel in order to obtain a better breakdown of the results and validation measurements.

Perspective wights

Customer-centricity Maturity Level	**Technology/ Data Perspective**	**Organization Perspective**	**Customer Perspective**	**Inconsistency**
Expert 1	0.31	0.33	0.36	0
Expert 2	0.34	0.33	0.33	0
Expert 3	0.23	0.32	0.45	0
Expert 4	0.38	0.32	0.29	0.01
Expert 5	0.24	0.23	0.53	0
Expert 6	0.16	0.3	0.54	0.03
Expert 7	0.35	0.3	0.35	0
Mean	0.29	0.30	0.41	0.02
Min	0.16	0.23	0.29	0.00
Max	0.38	0.33	0.54	0.14

Table 84: Perspectives Weight Results in Pilot

Criteria Weights

Customer-centricity Maturity Level	Infrastructure Integration	Data Distribution and accessibility	Data Collection Robustness	Employee	Leadership	Strategy	Awareness and Training	Options and feedback	Loyalty and commitment	Inconsistency
Expert 1	0.12	0.09	0.1	0.1	0.11	0.12	0.15	0.1	0.11	0
Expert 2	0.1	0.11	0.13	0.09	0.08	0.16	0.1	0.07	0.16	0
Expert 3	0.05	0.08	0.1	0.07	0.11	0.14	0.11	0.18	0.16	0
Expert 4	0.11	0.11	0.16	0.12	0.12	0.08	0.08	0.07	0.14	0.01
Expert 5	0.08	0.08	0.08	0.13	0.05	0.05	0.15	0.15	0.23	0
Expert 6	0.05	0.07	0.04	0.05	0.09	0.16	0.11	0.15	0.28	0.01
Expert 7	0.32	0.01	0.02	0.02	0.22	0.06	0.34	0.01	0	0.14
Mean	**0.12**	**0.08**	**0.09**	**0.08**	**0.11**	**0.11**	**0.15**	**0.1**	**0.15**	
Minimum	**0.05**	**0.01**	**0.02**	**0.02**	**0.05**	**0.05**	**0.08**	**0.01**	**0**	
Maximum	**0.32**	**0.11**	**0.16**	**0.13**	**0.22**	**0.16**	**0.34**	**0.18**	**0.28**	
Std. Deviation	**0.09**	**0.03**	**0.05**	**0.04**	**0.05**	**0.04**	**0.08**	**0.05**	**0.08**	
Disagreement										**0.051**

Table 85: Criteria Weight Results in Pilot

As it can be seen from the table above, the inconsistency for both perspective and criteria are in the acceptable ratio and are below 10% except for Expert #7 that Criteria Inconsistency is above the threshold introduced by Kocaoglu in 1983,

In addition, the Disagreement is below the 10% threshold and within the acceptable range with being 0.051 in the HDM model pilot implementation for the Comprehensive exam

The weight of each element is calculated by aggregating (averaging) experts' results. These weights are called **local weights**; they, in turn, are multiplied by their parent element (or parent elements in case of several levels) weight(s) to obtain the **global weight** of each element.