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Improving Customer Value Co-creation through Customer Engagement and Requirements Engineering Practices in a Small Software Company

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Abstract of master's thesis

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A small software company has startup thinking which is often short-term. This may negate requiring planning for long-term growth, and sustainability, which could have its impact on customer value. Customer engagement (CE) and requirements engineering (RE) practices are customer satisfaction and growth oriented; helping a small software company earn competitive edge, increase productivity, and grow while delivering on customer value. To address the stated problem, the research problem is stated thus: How do CE and RE practices impact customer value (CV) co-creation?

An action research study was carried out to understand better CE and RE practices at the case company. For data collection triangulation of semi-structured interviews, informal conversations, participant observation, and work experience were used. Data analysis did use some grounded theory features — interpretative statements in gathering and organizing the data got.

CE practices such as having dedicated customer co-creation platform, constantly learning from users, customer segmentation, and broadened view of customer were observed to have positive influence on customer value co-creation. RE practices that advance customer value included customer participation, face-to-face-communication, continuous planning, and requirements management. The level of success of these practices was influenced by differences in customer participation level, elicitation techniques scope, and selection of the techniques. Also, lack of dedicated user environment hinders user interaction and user-centered co-creation.

Customer engagement strengthens RE practices through active interaction between provider and customer to positively influence CV co-creation. Such interaction could be amongst provider, customer and end-users. There are four CE practices and seven RE practices established at the case company. Understanding CE significantly, and some of its practices, coupled with RE practices that yield high-perceived value may significantly help improve customer CV co-creation. Practices like detailed documentation, use of prototype, change and requirements management, co-creation platform, and participation in the platform can be improved upon.

Keywords Customer engagement, customer satisfaction, affective commitment, calculative commitment, loyalty, advocacy, customer engagement value (CEV), customer needs complexity, elicitation techniques, iterative requirements gathering, customer engagement cycle

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ABBREVIATIONS

B2B: Business-to- Business —interaction where each party has end users or have a corporate existence implying further their customers may not necessarily be the end-users. Analogous to C2C except in C2C each party or actor may be its own end-user or benefits or customer value is solely determined by them and not a third party.

B2C: Business-to-Customer —In this case the customer interacts with the business but the customer determined significantly what constitutes value or customer value as they are the recipient of the product developed and pay for the provider's (business') services.

C2C: Customer-to-Customer —interaction is where each party has end-users or develops the product to be used by others but like in B2B each party sees themselves as co-equals or equal benefactors and beneficiaries simultaneously.

CE : Customer Engagement— all activities in carrying customers along from connecting with them to engaging (*being in a mutual lasting relationship with*) them

CEB: Customer Engagement Behavior —user's behavioral pattern related to using a company's software

CEV: Customer Engagement Value —summation of CLV, CIV, CRV and CKV (*see them below*)

CIV: Customer Influence Value —ability possessed by a customer or user of a company's product of swaying other customers in or away

CKV: Customer Knowledge Value —innovation idea to knowledge contributed by a customer or some other persons outside a company's usual payroll

CLV: customer lifetime value —monetary value of all purchases by a customer over a given time

CRV: customer referral value—a positive influence of a customer to increase a company's customer base

CSN: company (or customer) Social Network— an environment or platform provided by a company for its customers or user group for a product or for a company's product offering.

CV: customer value —benefits a user or customer gets from using a company's software

CVE: customer virtual environment —like CSN a virtual environment for customers to communicate with provider or interact with other users or customers

RE: Requirements engineering — systemic management of customers' or stakeholders' concerns

SaaS: Software-as -a-Service — an application developed by a company for its customers where customers do not buy it but subscribe to the service for a given duration

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1. Introduction

Small software companies are ubiquitous and gaining popularity (Bosch et al. 2013). A small firm in the context of software companies and particular to this case company is one with less than 20 employees; using strictly workforce as a yardstick. More precisely, Carson (1990) explains that possessing any two of four characteristics defines a company as small including: independent firm management often with managers as owners; small group or individual owners with limited resources (Lindgren & Münch 2016); operation premises is local – though served markets need not be local; firm size – sales volume, employees or other factors. The case company in this research meets the definition criteria either way. Given the relative short existence, scarce and limited resources, it becomes beckoning to minimize resources. Lean thinking (Bosch et al. 2013) is used in meeting providing the offerings to customers with consequent realities which may play out in customer satisfaction, or worse yet in repurchase propensity. The hallmark consequence is on the value, so got from the use of such product or service, by the customer or end-user. While this may not always be the case in all projects, limited resources; particularly knowledge-base, can be a deterrent to delivering (potential) value by provider.

The case company, a virtual reality (VR) software firm was thought of in fall of 2015 when the board members came together. In June 2016, it was formally registered as a corporate entity in Finland. Besides, it delves into augmented and mixed reality. Hereafter, the firm where the research was carried out may be referred to as Mixed Reality (MR) Inc or case company. The firm is a small, relatively young, profitable, and innovative software company with huge potentials in the Virtual Reality (VR) software space in Finland. MR Inc is located in Helsinki, Finland. It has successfully delivered software products to notable clients over the past 4 years. Besides software projects of customers, MR Inc. has software-as-a-service (SaaS) platform where VR services offering is available to customers who are signed on to use provided solution. In addition, MR Inc provides generic software solutions to its requesting customers across industries – from education, tourism, medicine to history and the likes.

1.1 Motivation

A small software company (Devadiga 2017) may lack the software engineering professionals in key areas as requirements engineering, and customer engagement which have their consequent impact on customer value. From experience, it may not in the long term be enough for a young firm to be innovative; without a mitigation plan, if these areas are significantly wanting. There is a high propensity of small software firms' project being challenged or failing altogether, with Bosch et al. (2013) claiming over 98% of small software firms do not see the limelight. Furthermore, Giardino et al. (2014) claim the course of failure is often self-imposed, and that this self-destruct paradigm accounts for 90% failures in small firms. These observations are concerning and call for adequate risk mitigation and management strategies while ultimately strengthening the value proposition the firm proffers to the client (Schön et al. 2017).

Observation gathered from practice and research show the key areas of requirements engineering practices, software customer engagement (CE), and enhancement of customer value co-creation are pivotal or at least good to have in foraging the storm that limited resources and need for growth present in a small software company. Aranda, Easterbrook & Wilson (2007) posit that in small software firms the CEO is the requirements engineer. At a lower level Schön et al. (2017) advocate an antecedent of customer engagement – customer collaboration be practiced – emphasizing it is a critical pedestal for project success; though the author thinks it improves customer satisfaction and not necessarily a lone success

determinant. Bocken, Rana & Short (2015); and Lago et al. (2015) amplify the need to ensure economic sustainability, which if not present or lost could have grave consequences for both developer (provider) and customer. To meet these needs or mitigate possible challenges in a small software firm, Hussain et al. (2016) unequivocally state that in software development projects success will be an illusion if requirements engineering were significantly downplayed.

Lehtola and her colleagues (2009), in arguing for ensuring software product development success, observe that the link between [business] strategy and product development is not dismissible. This position is equally shared by Hussain et al. (2016) stressing that RE is essential to every software development project.

In formulating corporate strategy, in pursuance of corporate business goal, customer engagement, is advocated and will be pivotal in scoping the benefits of software process or development methodology the firm may choose, though the current trend seems to favor iterative development and a lean thinking approach. To further advance the corporate goal for the developing firm and even customers particularly in B2B context, good RE practices as it suits the product or project will be crucial in ensuring the *potential* value or value proposition, the provider puts in place, with which the customer (or precisely user) ultimately creates value in their value creating processes or use context (Bolton 2011; Komssi et al. 2015).

1.2 Research Problem and Questions

The research problem this thesis attempts to address is on the role of customer engagement, some of its practices, and good requirements engineering practices, on customer value co-creation in a small company. It uses MR Inc as a case study and attempts to know the contributions, positive or negative, of these practices on customer value co-creation in small software firms (Devadiga 2017).

1.2.1 Research Problem

To address the problem so explained, the research problem is stated thus:

How do customer engagement (CE) and requirements engineering (RE) practices impact customer value co-creation in a small software company?

1.2.2 Research Questions

To further explicate the research problem into addressable units with focus on systemic literature review and empirical study and recommendations, the three research questions below are presented.

RQ1: *What customer engagement and requirements engineering (RE) practices are in place at the case company?*

RQ2: *Which customer engagement (CE) and requirements engineering (RE) practices can improve customer value (CV) co-creation?*

RQ3: *What recommendations can help the case company improve current CE and RE practices?*

1.3 Scope of the Thesis

This thesis is formulated to assess the role of customer engagement and RE practices in customer value co-creation in a small software firm. The focus was on understanding customer engagement as a key concept in software engineering vis-à-vis RE practices as complementary unit of requirements engineering

in accentuating holistic customer value (co-)creation. In Komssi et al.'s (2015) words, the focus here is 'value for the customer' and 'value of the customer'. Business value is derivable from the developed software system by developer and customer.

The focus area in the empirical study is on understanding the current practices of the case company in these key areas:

- Customer Engagement (CE) practices
- Good Requirements Engineering (Software Features holistic systemic management) Practices
- How the above two areas contribute; each or jointly to customer value creation or co-creation

The systemic literature review encompasses building knowledge; particularly in CE, to aid CE & RE practices understanding and adoption. Literature review also examined how RE & CE practices impact Customer Value (CV) co-creation. Lastly, this thesis makes recommendations based on empirical studies and literature review on practices that can help deliver at case company additional customer value co-creation benefits for client & provider.

1.4 Structure of the Thesis

This thesis starts with an introduction detailing the motivation for this research, the research problem that it hopes to address using the stated research questions. It is these research questions that the entire thesis attempts to address in both its literature review and empirical study. The introduction is the first chapter.

Subsequently, secondary study research (Systematic literature review SLR) is carried out to gain insight into key concepts. Building on knowledge gained during the course of the author's Master's program at Aalto University, which will be indispensable in analyzing and synthesizing the SLR, empirical study findings and making inferences from them. Also, recommendations will be proposed based on available empirical data or other unexplored knowledgebase that may aid customer value delivery. Prior to the literature review in details, how the SLR process was carried out is first itemized and explained in the first section of chapter 2, Research Method. The second section of chapter two highlights the preparatory process or background for the empirical study at MR Inc. Chapter 3 presents the SLR in three main subheadings customer engagement (CE); Requirements Engineering; and Customer Value Co-Creation while a fourth subheading summarizes the chapter. After the empirical research, in chapter 4, the key findings are discussed. In chapter 5, Discussion, including validity threats is presented, and Chapter 6 presents the conclusions.

2. Research Method

To investigate the possible impact of good customer engagement (CE) and requirements engineering (RE) practices in the co-creation of customer value the author is seeking to ascertain the correlation and applicability of CE in software engineering domain and aggregate evidence on CE and RE individual practices on customer value co-creation. To achieve this goal, of the three major process stage advocated by Brereton et al. (2007); and Kitchenham & Charters (2007) for systemic literature review as a way of aggregating such evidence, the author has itemized the subsection of section 2.1 on Literature Review.

2.1 Literature Review

In this section how the literature with which aggregated evidence was obtained, known as primary study (Brereton et al. (2007), is stated. The primary study is divided into the search, and selection process. The secondary studies – how the review of the primary studies was analyzed is in section 2.1.5. Besides, the empirical study; building on accumulated evidence from the SLR; was mainly on how the action research was conducted at the case company detailing the planning and or preparatory phases. The empirical study is presented in section 2.2 with heading **Empirical Study**. The literature review is based on understanding the second research question (RQ2):

Which customer engagement (CE) & Requirements Engineering (RE) practices can improve customer value (CV) co-creation?

To better approach the search strategy three **complementary research questions** (CRQs) (Schön et al. 2017) were developed. They are:

CRQ1: How can customer engagement and agile requirements engineering practices influence customer value co-creation?

CRQ2: What challenges can agile requirements engineering practices present to customer value co-creation?

CRQ3: What challenges can customer engagement present to customer value co-creation?

The holistic purpose of this further delineation was to help structure the search strategy in such a way to allow for as much research results with possibly cross discipline search results. Kitchenham & Charters (2007) advice to allow for a richer research, specific researchers in the research field should be consulted for advice on appropriate literature. Much as this was not initially intended in the customer engagement subcategory, a researcher in the field of Sales, Marketing and Management proposed sources which the search results had produced including notable researchers in the field of customer engagement in particular. To buttress soliciting empirical evidence from related discipline, Kitchenham & Charters advocate the need to source studies in related field where a given concept or topic is not so well developed, which is the case in software customer engagement. In each of the major categories research (literature) identification, expert consultation was added to the used research articles or papers coupled with the selection from primary studies as represented in the search strategy.

2.1.1 Research Literatures Search Strategy

Haven constructed the research protocol (Kitchenham & charters 2007), the author proceeded to find as many publications as possible relating to Customer Engagement; Requirements Engineering; and

Customer Value Co-Creation. This was done using an unbiased approach as advocated by Kitchenham & Charters (2007) to eliminate systematic errors and improve internally validity.

The search strategy used trial searches with the research question (RQ), with the complementary research questions (CRQ) to enunciate or better understand the impact of CE and RE practices on customer value co-creation. To ensure a systematic search process, the research question was segmented into three categories: customer engagement, requirements engineering, and customer value co-creation. From each of these categories key words were retrieved using RQ2 and related CRQs. Table 1 below shows the correlation of the categories and the keywords so derived.

Table 1. Research Question Categories, Search Results & Selected Literatures Count.

Category	Keywords	Results
Customer engagement (CE)	CE, CE process, agile CE, customer collaboration, customer involvement, customer participation	~24 700
Requirements engineering (RE)	RE benefits problems and solutions, RE challenges, RE practices, RE process	~10 400
Customer value co-creation (CV)	Customer value, customer value co-creation, agile customer value	~21 400

Subsequently, the keywords were linked and subsequently preceded by 'software' – helped marginally reduce outcomes by about 300 results – except customer engagement where 'software' was not used. The category's keywords units were interconnected with an OR Boolean operator as shown below:

CE – (“customer engagement” OR “customer engagement process” OR “agile customer engagement” OR “customer collaboration” OR “customer involvement” OR “customer participation”)

RE – software AND (“requirements engineering benefits, problems and solutions” OR “Requirements engineering challenges” OR “requirements engineering practices” OR “requirements engineering process”)

CV – software AND (“Customer value” OR “customer value co-creation” OR “agile customer value”)

The *helper*; 'software', was not used in searching CE search text. This was because it had a bias to software engineering and per Kitchenham & Charters' advice, that restriction is unnecessarily and given the lack of any significant research on this topic in software engineering, the search was allowed to look up results from related disciplines. When the helper was initially used, the result gave around same results count as without it of about 24 400, but notably almost no customer engagement research in software engineering was visible, as the only article that was prominent with the title including customer engagement second on the list, clearly used an antecedent of CE; related agile concepts – 'participation' or 'involvement' or 'collaboration' almost throughout in the article, except for the title. Removing the restriction as stated above the result was around 24 400 research in line with Marketing Sciences Institute's (MSI) call for prioritizing CE in the years 2010–2012 (Bolton 2011; Brodie et al. 2011). Besides the three categories, the author, using same strategy, searched for research in systemic literature review (SLR) and qualitative analysis research to better understand SLR and qualitative research in general. Table 2 below presents the digital library used, strategy and the duration of search.

Table 2. Search Library, Strategy and Search Duration.

Digital Strategy library	Search Strategy	Search Duration
Google Scholar (Main Library)	Full text	15.05.2019 – 12.11.2019
Research Gate	Research title, authors	18.10.2019 – 15.12.2019
IEEEExplore	Title, authors	18.10.2019 – 15.12.2019
Semantic Scholar	Title, authors	18.10.2019 – 15.12.2019
Sage Pub	Title, authors	18.10.2019 – 15.12.2019
Science Direct	Title, authors	18.10.2019 – 15.12.2019

As shown in Table 2 above, Google Scholar was the main digital library used. However, when the research (literature) was presented or sourced as a PDF with no clear indication of its publishers or when for any reason in doubt, Research Gate proved useful in stating the source's origin. Also, Research Gate attempted providing a reference to the source material though it often left out the volume's issue number and city details for conferences. Hence, it was a source to better understand the origin of the literature sought. For every other digital library outside Research Gate, they served as digital library when Google Scholar referred an initial selected paper to the publisher e.g. IEEEExplore (IEEE Software), or another possibly non-publisher digital library (Semantic Scholar). In another case where an expert in the field; with each having over 20 years research experience in Requirements Engineering or Marketing respectively, had recommended the research papers or articles; author experienced that in all three categories, a direct search of the article was done in either Research Gate or Google Scholar. Using Research Gate as a library, search was done by simply imputing the title of the article or a list of the authors, though the former was the most used.

Filtering the large results was needed in finetuning the search criteria. To achieve this, a deliberate attempt was made to research or search ONLY articles from select journals and conferences – source – (Inayat et al. 2014). Some of the criteria used included e.g. IEEE Software, written in English language, relates to the contextual category interest domain. Also, titles of the large obtained studies were observed to deviate significantly from the research area even where these keywords were present. The researcher ensured there was *no space between 'source' and the first journal or conference to search from*. Below are the reproduceable search strategy applied:

CE – *allintitle: "customer engagement" OR "customer collaboration" OR "customer involvement" OR "customer participation" source:"Software" OR "Marketing" OR "Business" OR "Commerce Research" OR "Service Research"*

RE – *allintitle: "requirements engineering process" OR "requirements engineering challenges" OR "requirements engineering benefits" OR "requirements engineering practices" source:"Software" OR "systems" OR "requirements" OR "Computers"*

CV – *allintitle: "customer value" OR "value in agile" OR "value co-creation" OR "value co-destruction" source:"Systems" OR "Software" OR "Marketing Research" OR "Brand Management" OR "Service Research" OR "requirements"*

Table 3 below shows how the strategy eased out and made the search process easy to manually iterate and scan for suitable literature for the research question. It is worth noting that in the RE category, 'RE process' addition to the keywords accounted for more than 400 additional search results.

Table 3. Advanced (Final) Search Strategy Leading to Selection.

Category	Keywords	Results (selected)
Customer engagement (CE)	CE, CE process, agile CE, customer collaboration, customer involvement, customer participation	235 (16)
Requirements engineering (RE)	RE benefits problems and solutions, RE challenges, RE practices, RE process	530 (33*)
Customer value (CV)	Customer value, customer value co-creation, agile customer value, value in agile	311 (36*)

*adding mainly expert recommendations (see Figure 1 in next section)

The motivation for using Google scholar as main digital library spans from the verse available research articles given its wide integration with other digital libraries. The motivation for IEEEExplore, Science Direct and Sage Pub, is the availability of the research in pdf format that is often downloadable and a novel suggestion of related research that cover same or similar topic from which the researcher could make a choice – they were more like a digital automated *suggestive* snowballing bot. Generally, the motivation also derives from Kitchenham & Charters' (2007) advice on the usefulness of most of these digital libraries to the software engineering community.

2.1.2 Literature Selection Techniques

In determining which primary studies is included in the selection or excluded, Kitchenham & Charters (2007) propose basing it on the research question. In this thesis' literature review each category of RQ2 so derived has its unique criteria besides generic criteria that all three categories share.

Inclusion. The general criteria include articles in written in English language, featured articles in journals or conferences, study or research is in and addresses the category from the research question and the title is relevant to each category's keywords (Neto & Santos 2019). Based on the relative category, the selection process generally considers the relative context or applicability to software engineering, except for customer engagement (Kitchenham & Charter 2007) from the abstract, keywords, discussion and conclusions. Besides the title's relevance or when similar topics are covered, the citation count was significantly used. While this may have possible bias in some digital libraries, it was observed that the most citations were stated on Google Scholar. Also, the citation count was always relative to the publication's year in prioritization e.g. 2007 publication with citation count of 1024 and 2015 with citation count 1013; the 2015 publication was prioritized when most conditions (*empirical data or analysis*) are same or comparable. Citation count was looked up on Google Scholar, IEEE Explore, Semantic Scholar, Research Gate or any referenced Digital Library – at least once.

Exclusion. Articles not written in English, papers not published in journals or conferences in the specific digital library related space e.g. IEEEExplore's Software, or Journal of Marketing (*customer engagement*). In additional papers published in the used digital libraries but which did not measure up on quality assessment: empirical evidence, researched firms: size and numbers; citations less than 20 (for articles older than 12 years); authors – the more the higher score; research duration; and empiricism-based conclusions. All of these accounted for quality assessment (See Table 4 below).

Using the inclusion and exclusion principle (see previous section), initial selection started at stage two (S2) as Figure 1 below depicts.

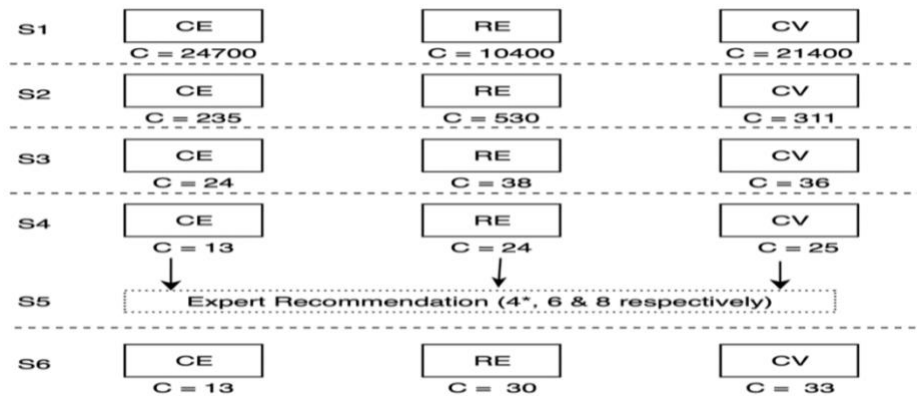


Figure 1. Search & Selection Strategy Design.

*done after S3 or scanning the abstracts and conclusions.

- S1 – ANDing or ORing category and keywords – CE had no ANDing
- S2 – search strategy implementation with part selection criteria –title lookup
- S3 –abstract, keywords, conclusions scanning
- S4–reading through the articles or publications
- S5–combining expert recommendations
- S6–selected and used papers per thesis main categories

Quality Assessment. To aid the selection process that Figure 1 above explains, quality metric was proposed and used in the selection process. Table 4 below gives a summary representation of the quality assessment (QA) metrics used.

Table 4. Quality Assessment Criteria Strategy used in selecting the primary study.

Key Criterion	Description	Grade Scale
Firms count	firms studied	(0.5,1,1.5,2.0) [$\leq 2, \leq 10, \leq 50, > 51$]
Firm max. size	Largest firm’s size	(0.5,1,1.5,2.0) [$\leq 20, \leq 100, \leq 500, > 500$]
Conclusions	Empiricism backed	(0.5,1,1.5,2.0) [somewhat, OK, very clear, really sound]
Citation count	Per year citation	(0*,0.5,1,1.5,2.0) [$\leq 20, > 20 \ \& \ < 50, < 100, < 400, > 500$]
Study duration	Completion years	(0.5,1,1.5,2.0) [$\leq .5, \leq 1, \leq 2, > 2$]
Valuation	Usefulness to thesis	(0.5,1,1.5,2.0) [somewhat, OK, highly, excellent]

*except where publication was less than a year (qualifies for 0.5)

Literature in the primary study with a QA score of not greater than 2.5 were generally excluded in the selection process besides the earlier stated exclusion rule. The inclusion and exclusion rule were used in the selection process. Reading through the abstract, keywords and scanning the conclusions, stage two (S2) from Figure 1 was reduced to stage three (S3). The QA metric defined in Table 4 above was applied to the read literatures (S3) and this resulted in stage four (S4). For CE, the expert recommended articles were all already part of the studied and selected articles. This was the case, for CE, as the expert assistance was sought after the initial search strategy & selection (S2) had been applied. For RE & CV, expert advice was sought, and the publications had been ready prior to the search strategy. Hence, no attempt was made to include them in digital library search results, as they were already in the to-be-read study.

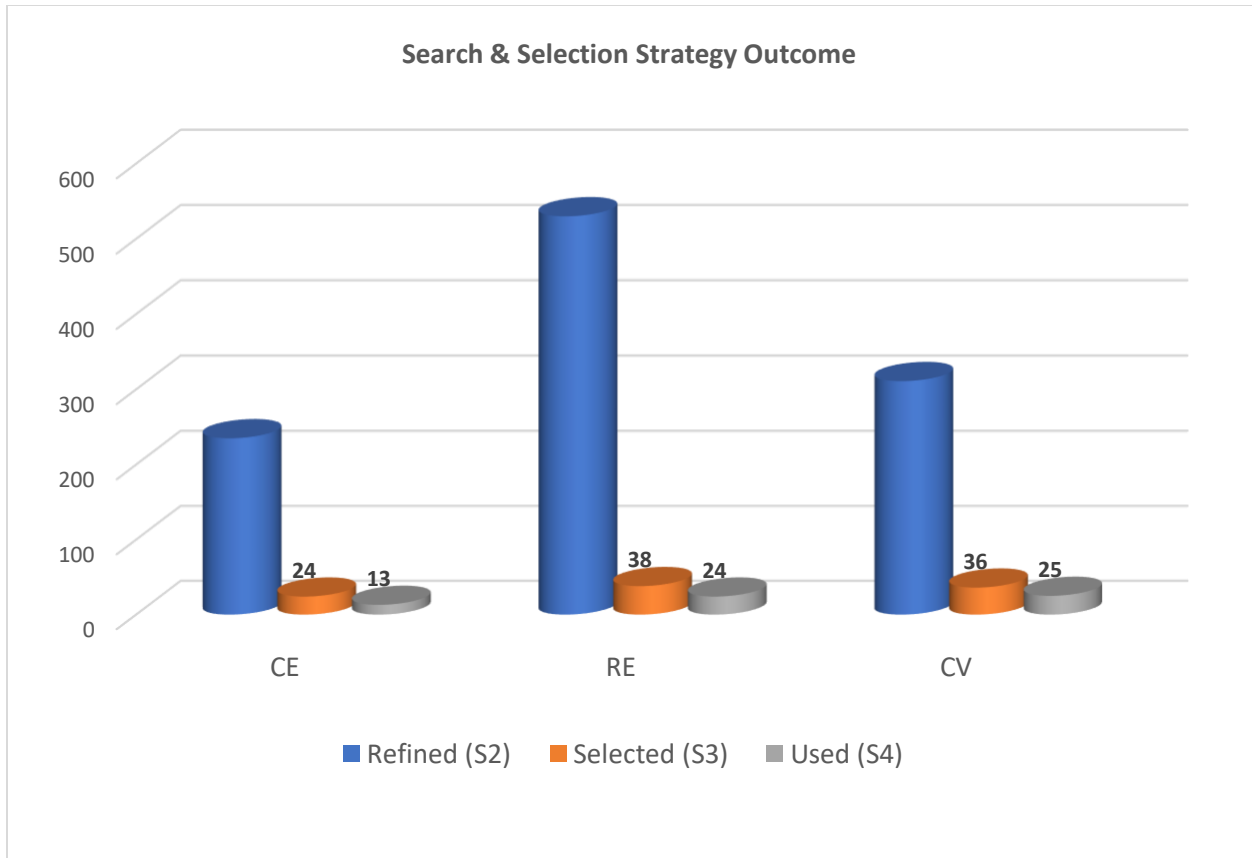


Figure 2. Result of applying multiple stage selection process and selection strategy.

2.1.3 Systemic Analysis & Synthesis of Information from Used Literature

Analysis of the literature was mostly done at stages three and five (S3 & S5). Per Brereton et al (2006) a process was defined in identifying primary studies that were relevant to the research. The form used had titles, authors, and references at a higher generic level of abstraction for all three categories reviewed. Based on their categories, relevance to the various themes was reviewed. The QA metric was enhanced by further reviewing the location, validation technique, methodology (Inayat et al. 2014). Tables 5-7 below reflect the themes, short description, and sources (references) used in the thesis' literature review.

Table 5. Customer Engagement (CE) sections, intros and main references used.

Theme	Description	Sources
Definitions	Antecedents, consequences of CE, and CE defined	Vivek et al.; Brodie et al.; Zhang et al.; Bowden; Jiseon & Ki-Joon;
CE Impact on CV creation	The business benefits of CE to provider & client	Prior & Marcos-Cuevas; Shelly & Rosenblatt; Kumar et al.;
CE Behavior & CE Environment	Understanding and living in the to-be, was and transactional customer's experiential exchanges; inferences of client virtual setting	Zhang et al.; Jaakola & Alexander; Kumar et al.; Brodie et al.; Bijmolt et al.; Sashi
CE & Agile Concepts	CE, customer involvement, participation or collaboration – comparison.	Bowden; Kujala et al.; Jaakola & Alexander
CE Cycle & Process	Iterations and aggregation of CE stages – enhancing CE benefits	Bowden; Sashi; Vivek et al.; Bijmolt et al.
What Does CE Really Mean?	Coalescing the antecedents, consequences, value, cycle and process of CE in its definition.	Bijmolt et al.; Zhang et al.; Sashi; Bowden
Capturing Holistic CE Value	Understanding the value of a customer beyond a mere customer lifetime value, including pre- & post-transactional value.	Kumar et al.; Bocken, Rana & Short;
Impact of CE on CV Co-Creation	What customer value lies in CE for the value creation process and its added benefits, if any.	Zhang et al.; Jaakola & Alexander; Bijmolt et al.; Nazakat & Hong;
CE Opportunities and Challenges	Where some exploitation spots are and what negative impact CE could have on a firm	Bolton; Vivek et al.; Beatty & Morgan; Zhang et al.; Kumar et al.

Table 6. Good Requirements engineering (RE) Practices sections and main references with intros.

Theme	Description	Sources
Impact of RE on Software Projects – Motivation	Not getting RE right, accounted for over 70% project failures in 2012.	Hussain et al.; Kujala et al.; Hofmann & Lehner; Kamata & Tamai; Lindgren & Munch
RE Process	Specifications are better spelt out e.g. with domain analysis	Hofmann & Lehner; Kapyaho & Kauppinen (2015); Kauppinen et al. (2007)
RE Elicitation Technique Selection	Deduce which technique better suits a project, client or situation. Most companies only use one	Hickey & Davies; Kapyaho & Kauppinen (2015); Nazakat & Hong;
RE Challenges & Practices	What inundates RE practices and what practices are common or known successes per circumstance	Inayat et al.; Itkonen et al.; Komssi et al. (2010, 2013); Bjarnason et al.; Schön et al. (2017); Niazi et al.; Cao & Ramesh; Heikkila et al.; Cox et al.
Agile RE Benefits, Problems & Solutions	Motivation, mitigator factors and how to overcome them.	Itkonen et al.; Komssi et al. (2010, 2013); Firesmith; Avgeriou et al.; Cao & Ramesh; Racheva et al.; Kapyaho & Kauppinen
Identifying High Perceived Value RE Practices	Practitioner's perception driven RE practice usage with organizational or project benefit.	Niazi et al.; Cox et al.; Zhang et al.; Mendes et al. (2015)

Table 7. Customer Value (CV) themes together with references and intros.

Theme	Description	Sources
Who is a customer?	One who adds or creates value in any interaction with the provider firm's focal offering. Must they be transactional, if yes, when does their status expire, if no what must they add to the providing firm.	Kapyaho & Kauppinen; Bowden; Brodie et al.
What is value?	Customer value entails value for both customer and client. Looking at how each party sees value in context.	Alahyari et al.; Aurum et al. (2006); Dingsoyr & Lassenius; Kumar et al.;
What is co-creation?	An overview of interactional experiences that add value to the value-creating unit – the customer <i>or</i> user. Provider offers potential value, or value proposition	Ramswamy & Ozcan; and Kumar et al.
Customer Value Definition	In a co-creative interactional context, value is in the exclusive domain and subjective to the user in their use context. Defining the value of and for the customer to the provider.	Barney et al. (2006, 2008, 2009) Alquist & Senior; Wohlin & Aurum; Dingsoyr & Lassenius
Value Creation in Small Software Firms	How small entrepreneurial firms see value creation. Is it a co-creative process, do they seek to get anything back than transactional business value, know the users use context post transaction? Relate this to how organizational strategy could be hind sighted.	Grönroos; Prahalad & Ramaswamy; Lenka et al.; Mikkonen et al.; Reypens et al.; Ekman et al.; Prior & Marcos-Cuevas

For each category, the form Brereton et al. (2007) proposed was used in storing information got from each literature. No advanced software was used for this purpose; simple Excel sheet was used for storing titles, authors, and references, and the articles were read in electronic format allowing for the highlighting of key and important information piece. These collectively were useful in synthesizing the key information contained in each subset of study as shortly presented in Tables 5–7 above. Additionally, snowballing was used mostly for studies that helped also in the structuring of the thesis particularly with the structure of the systematic literature review. Another area where snowballing was considerably used is in the general qualitative research. In all, about seven (7) references, including two books, were snowballed from the available studies.

2.2 Empirical Study

The goal of the empirical study in this section is to describe the case company and practices as they relate to customer engagement, requirements engineering practices, and co-creation of customer value. To achieve a more detailed perspective, more formal approaches for data gathering was used, chiefly interviews. Also, the author had close collaboration with the case company about half a year and carried out informal ethnographic studies or observation, asking questions and noting responses as they relate to these concepts.

Like stated earlier, the objective of this thesis is not to go through or present any particular project, product or offering of the case company but review customer engagement and requirements engineering practices that culminate into value creating hallmarks for the customer. Besides, this section hopes to accentuate the case company's offering, whatever they may be – products or projects, in enhancing its strategic goals or help it create competitive edge (Kauppinen 2009).

2.2.1 Case Description

The Case company in this empirical study is a small software company (Bosch et al. 2013) located in the heart of the city of Helsinki. It specializes in virtual reality (VR) solutions. Some of its clients include notable industry players in hospitality, tourism, education and others. It mostly develops bespoke (customized or tailored) software for its customers though it has a product which it offers as SaaS (software as a service). It has about 10 employees, with mostly senior employees doubling as directors or co-owners of the company. Some of the positions as stated in the organogram include chief executive director (C.E.O), chief technical director (CTO), Chief Strategy (or *Scientific*) Officer (CSO) Design Lead and Researcher with all occupants of these positions, at the time of writing, also directors or co-owners.

The industry where most customers to the case company operate include education, history or museums, aerospace, oceanography, hospitality and general entertainment. Projects, as mentioned earlier, is the mainstay of the case company. Its projects usually run from 3 months to a year, though overruns may sometimes occur. This is not a slip on the management but may have a bearing on what Hofmann & Lehner (2001) observed in their research about success factors of a software project which were chiefly hinged on the requirements engineering practices and process in place. Hofmann & Co. observed that not getting the requirements right – knowledge, resource, and process – was a huge cause of challenge or failure. Cao & Ramesh (2008) emphasize the lax in adapting to evolving needs in a dynamic environment as software firms find themselves is a precipice for failure. To get the needs discovery right, Cao & Ramesh conclude an iterative process would be most suitable approach.

2.2.2 Research Process

Following the research scope, this thesis research needed a research method that gives a balanced overview base for understanding small software companies; their current customer engagement holistic state and general requirements engineering practices vis-à-vis customer value proposition. This position is strengthened by Avison et al (1999) who amplify the strength in qualitative research in assessing organization practices. To achieve this, action research (Avison et al.), with in-depth interviews was selected as the research method of choice. The researcher and some executives of case were interested in knowing about the challenges inherent in these areas of customer engagement (CE) and requirements engineering (RE) practices in customer value (CV) proposition delivery. The goal was to understand benefits including possible challenges in adopting the practices to increase customer satisfaction and loyalty while fully understanding the cost and implications. In-depth interview was added given the researcher was not continually involved in the day-to-day activities of the case firm per overseeing the implementation of the findings; in-depth interviews kept the loop to know about current happenings to effectively study the case company.

2.2.3 Data Collection – Method, Sources & Background

Briefly, the methods used in data gathering are presented. Observations, or ethnographic studies, and more formal interviews are presented as sources of data used in this study. Also, the author haven worked in case company, triangulated further incorporating his experiences and how they relate to the subcategories in this thesis theme.

Experience. The author's work experiences contributed tangibly as a motivation for this thesis topic and research area. Experiences included both development and customer interaction. Having the customer come over to present what the needs were and overseeing or actively participating in the process was very helpful. However, when the customer does not clearly delineate the big picture into implementable units e.g. user stories, there is often ambiguity and much rework may ensue.

Interviews. Two (2) semi-structured interviews were carried out at the case company, and another one (1) was carried out in a Finnish ministry on software ecosystems. However, due to time constraint only the case company's interviews were used for this thesis empirical analysis. The goal was to ensure that those who were responsible or capable of influencing and implementing change were involved in the process to give the process any potential edge in implementation or being bought into. Accordingly, questions were structured to cover the three areas – two that contribute to customer value co-creation and customer value co-creation – targeted at both managerial roles including those in business and development (IT). The approach was motivated by some of the experiences of the author, and training, as change has its consequent cost, before the benefits surface or at least portend risk which most managers, and conceivably rightly so, are aversive to. To buy into change, the manager should be relatively acquainted with the motivation and possible benefits, more so where their decision alone may not suffice irrespective of their position. Notably, from the author's experience, transformation or any significant change implementation would have to be a concerted contribution of high-ranking staff personnel. Should the management or board members be left out of the interviews or awareness creation and knowledge impartation, the findings may easily be abandoned.

The semi-structured interview questions were structured to be non-leading, and possibly prompting follow up questions (DiCicco & Crabtree 2006) based on the respondents' answers. To ensure non-leading nature, and remove indistinctness and bias, the questions were presented to an expert who approved

them before they were applied. Each category had about 5 questions areas which the respondents were acquainted with to make the process easier. The interviews were carried out in the company premises in two iterations. In all two (2) in-depth interviews were carried out at case company and one (1) at a Finnish Ministry on software ecosystems, with each lasting over an hour.

The motivation for semi-structured interview was to keep the scope aligned with the thesis theme and to gain rich information from the respondents compared to using a survey (Nuseibeh & Easterbrook 2000; Kyyahyo & Kauppinen 2015). Kyyahyo & Kauppinen describe semi-structured interview as one that provides a framework for theme discussion. However, DiCicco-Bloom & Crabtree (2006) on the contrary argue that no interview can be truly unstructured. The interviews, on seeking respondents' approvals, were recorded and transcribed, as no notes were taken actively by the interviewer. This was done to make the interview atmosphere more friendly, help interviewer actively listen to the respondent and make the interview progress without any obstruction or interference (DiCicco-Bloom & Crabtree 2006).

The interview centered on the theme of the thesis, 'Improving Customer Value Co-Creation through Customer Engagement and Requirements Engineering Practices in a Small Software Company.' The categories, derived from the thesis topic included: Customer Engagement, Requirements Engineering Practices, and Customer Value. Seaman (1999) explains that an interview guide gives the interviewer some degree of freedom or flexibility. On the respondent's comportment and rapport, Seaman advises feigning ignorance, and stating no obvious right or wrong answers. These were useful in the process of data collection.

Background of Respondents for Interview Data

MR Inc., is relatively young and the number of employees is not that high. Those who accepted request for interview or volunteered to participate are two. They are involved in the day-to-day customer interaction and every phase of customer project development. Also, respondents are actively involved in requirements gathering, customer engagement, product management and monitoring of progress of company's products including some of MR Inc's software-as-a-service products. In more technical terms they would pass for requirements analysts or product managers though such titles are not expressly used at MR Inc. Moreover, interview participants have been with MR Inc for its entire corporate existence, offering their services for about 4 years already. Besides, respondents have prior work experience, possibly in other fields that are proving useful. Furthermore, respondents are well educated with interviewees having at least a Master's degree — one in Arts, Film and Television.

2.2.4 Data Analysis

Collected data, once obtained was analyzed using content analysis or narrative data analysis (Taylor-Powell & Renner 2003), and the strategy was hugely based on hermeneutics or grounded theory approach which Seaman (1999) termed constant comparison method. DiCicco-Bloom & Crabtree (2006) describe grounded theory as an editing approach where researchers make interpretative statements in their quest to finding patterns in organizing the data got. Taylor-Powell & Renner explain that narrative data or text varies in its occurrence and sources. DiCicco-Bloom & Crabtree argue that structured [or semi structured] interviews usually produce quantitative data. Such quantitative data from structured or semi-structured interviews emanate from qualitative data which when codified (Seaman 1999)– given numeric value can produce quantitative data. However, the main focus of this thesis' data analysis was on qualitative data. The source of the analyzed data is hugely from semi-structured interviews conducted. DiCicco & Bloom

argue observations and semi-structured interviews are usually the sole source of data in qualitative research.

To truly be able to analyze retrieved data, Taylor-Powell & Renner (2003) propose one got to know the data; focus the analyses on the research question before categorizing the information so retrieved. Per their advice, the cellphone recorded interviews were repeatedly listened to by the author at list 5 times each.

2.2.4.1 Knowing the Data

The audio recordings of the interviews were reviewed and listened to repeated for at least five times. Having listened to the recorded interviews severally, notes about impressions were taken. Nuseibeh & Easterbrook (2000) concur with Taylor-Powell & Renner (2003) on the possible usefulness of such impression notes or information contained at a later stage of the data analysis. Also, attention was paid to the quality of the data so presented, as Taylor-Powell & Renner warn that spending much time on data with no true value is a waste of resource.

2.2.4.2 Focus Analysis

The analysis in this empirical study was focused at two levels – question and category. Taylor-Power & Co (2003) propose categorizing the responses by question, topic, time period or event; or case, individual or group. They argue this way the hermeneutic connection can be clearly seen or compared from different respondents' responses. Hence, for each question an attempt was made to first segment the transcribed interviews by each question's response and the hermeneutic connections were thereafter identified. The question focus aided the category focus which followed much similar pattern.

2.2.4.3. Making the Categorization (Code Groups)

The raw data got from in-depth interview memoing (Birks Melanie, 2008) and understanding the data (Taylor-Powell & Renner, 2003) quotations were sought from the transcripts and themes (codes); where appropriate were developed. Such combination of quotation and theme is understood as a 'Code' in ATLAS.ti8 – a qualitative data analysis software tool used by the researcher. In some cases, some quotations either explained; expanded, supported, or criticized (*there are more options*) an already existing code –relation. In such a case, the quotation gets an already existing code as the Code Tree in Appendix E shows. Code is the smallest unit of making sense of the data. It is got from 'Open coding' (*organising raw data to make sense of it*) using raw data from interview transcripts: A code is a short descriptive theme of information contained in a quotation. At a much higher level the Codes did converge as correlation of codes crystalize. This process of joining the codes amongst or between one another is called axial coding (Birks Melanie, 2008). In ATLAS.ti8, this is called Code Group(ing). This process is exemplified in Figure 3 below.

ATLAS.ti Report

New Improving CV Co-Creation through Customer Engagement & Good RE Practices

Code groups

Report created by Omoifo Darlington on 16 May 2020

◇◇ CE Observations Findings

Created: 05/03/2020 by Omoifo Darlington, Modified: 18/03/2020 by Omoifo Darlington

Members:

- benefits:customer engagement
- customer engagement
- customer engagement benefit experience
- customer engagement channel
- customer engagement: a novel goal
- customer engagement: channel provider uniqueness
- customer engagement: must deliver value
- customer engagement: stages or phases
- customer engagement:advocacy
- customer engagement:collaboration
- customer engament benefit better estimation
- customer participation: levels
- customer participation: passive or slight
- customer partipation: total

◇◇ co-creation concepts, perspectives, and value

Created: 05/03/2020 by Omoifo Darlington, Modified: 15/03/2020 by Omoifo Darlington

Members:

- benefits co-creation:provider
- benefits:co-creation
- co-creation
- co-creation: B2B actor perspectives
- co-creation: understanding concept
- co-creation:funding source
- co-creation:growth avenue

Figure 3. Code Grouping Using ATLAS.ti8 for Open and Axial Coding – qualitative data analysis process.

From the open and axial coding represented in Figure 3 above, 15 categories (code groups) excluding a dedicated personnel category were obtained. The main findings originating from the data are derived from the code groups or categorization and presented in chapter four (4). Besides, per ATLAS.ti8 definition, 81 codes were got from the data with a total of 241 quotations. Kindly see Appendices D; for Code Group Tree, E; for Code Tree, and F; for the Links & Relations (53 Quotation Links, 7 Relations). The Relations (between a quotation and another), besides those mentioned earlier, include 'continued by', 'justifies', and 'criticizes'.

2.2.4.4 Data Analysis Sample Data Representation Introductory Data

During the course of the research and data analysis the occurrence of some mostly used words within the contest of the research question, customer engagement, requirements engineering and custom value, and software engineering was noted, though it may not be significantly inferential. Table 8 below depicts codification – in this context occurrence of words using ATLAS.ti8 Word Cruncher®.

Table 8. Occurrence of some commonly used software engineering words during interviews.

Term	Count	Percent
customer(s)	130	20,09 %
project(s)	108	16,69 %
software/product(s)	90	13,91 %
compan(ies)/provider	42	6,49 %
use/using	42	6,49 %
user(s)	30	4,64 %
want(s)	28	4,33 %
value	28	4,33 %
need(s)	27	4,17 %
create(s)/creation	26	4,02 %
design/develop/implement	20	3,09 %
sales/marketing	19	2,94 %
feature(s)	13	2,01 %
benefit(s)	10	1,55 %
challenge(s)/problem(s)	10	1,55 %
requirement(s)	9	1,39 %
engagement/relationship	8	1,24 %
involve/participate/collaboration	4	0,62 %
agile	3	0,46 %
Total Occurrence During Interview	647	100,00 %

Figure 4 below demonstrates graphically the data presented in Table 8 above. Words considered included customer, product, or project. Interestingly, of the almost 650 times these words occurred the aforementioned words were used over 50% of the times.

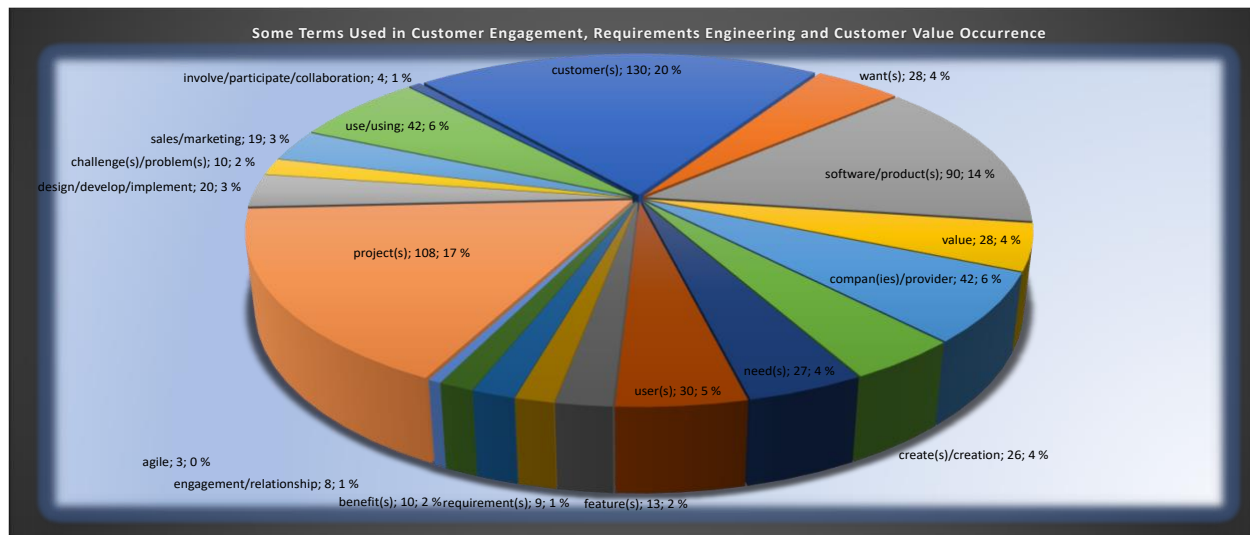


Figure 4. Occurrence in Empirical Study of some commonly used words in CE, RE & CV.

3. Customer Engagement, Requirements Engineering & Customer Value Co-Creation

During this thesis, systematic literature review (SLR) results or secondary studies covered the categories that arose from the research question 2 (RQ2) :

Which customer engagement (CE) and requirements engineering (RE) practices can improve customer value (CV) co-creation?

Hence, the SLR findings is presented in three categories. This includes, customer engagement (CE), requirements engineering (RE) and customer value (CV). The CE component focuses on the core knowledge of customer engagement as it supports a customer or contributes to her value co-creation. To achieve this, other components are mentioned or presented shortly such as CE behavior, CE value – total value obtainable from good knowledge of CE. The RE component focus on concepts and knowledge that help understand some good RE practices including challenges, problems, and benefits. Also, attempt is made to review the RE process and present some solution approaches to the identified problems. On the customer value co-creation, on closer look the two other components CE and RE contribute to, or impact; as it could be negative, customer value co-creation. It seeks to understand value in general from the customer's perspective mostly, but for both customer and the provider; or software developing firm.

3.1 Customer Engagement Theoretical Background

This subheading presents an introductory view of customer engagement (CE) and while it is important for a small software company in their customer value co-creation process, after which it presents some definitions for CE. It looks at what value CE brings for both customer and provider. CE behavior as it relates to impacting customer value and an environment for customer engagement interaction — one with a wide reach, is also presented. Next it compares some concepts in Agile Software engineering Practices that are often confused or wrongly used interchangeably such as in Hanssen & Fægri (Hanssen & Fægri 2006) in their article –**Agile Customer Engagement: a Longitudinal Qualitative Case Study**, where they rarely, if any, used CE in their article save abstract & introduction(?), but used involvement, collaboration or participation in the text (see section 3.1.2 or Bowden 2009 for more). The understanding presented becomes shallower with their claim, '*We find the focus on customer engagement to be particular interesting within the context of agile processes as this is one of the four foundational values of the agile manifesto*'. While that may seem to suggest the importance of CE to small software firms, and software businesses who are continually using Agile Manifesto in their offering, it leaves no distinction or any detailed understanding in the domains of pre-transactional, nor post-transactional experiential exchanges which galvanizes the core component of CE. Even at purely transactional level, it is yet a lax definition. To better understand the concept of CE, CE Process and Cycle is presented and CE is more precisely defined. Afterwards, ways to capture total customer value is presented drawing on CE knowledge and perspective. The motivation for CE in opportunities it brings, alongside some challenges it presents, are also considered. The impact of CE; from perspectives studied, on customer value co-creation is explained.

It will be noticed; a deliberate attempt is made to defer the definition of CE but present more traditional software engineering terms or concepts in comparison first. This is to make the definition, which will refer to these terms, more profound and grounded on the terms. Also, this will give a broader scope of CE as it relates to software engineering and more so company growth e.g. in small entrepreneurial companies.

3.1.1 Customer Engagement (CE) Motivation

Vivek et al. (2012) assert that in Marketing Science Institute (MSI), stressing research priorities areas, called for a better understanding of, '[customer] engagement' (CE). Vivek & Co. claim this remained a priority for MSI between 2010-2012. The question may quickly arise, what is CE's importance for software firms? Software business is one of the most dynamic business sectors where evolving technologies, changing customer needs and varying levels of satisfaction as solely defined by the customer leave little or no room for leniency in being involved in the customer's or users' everyday lived experiences with a software firms' solution or offering. That is even more important when a firm's resources, deliberate or constrained, might leave some room for issues like technical debt (Avgeriou et al. 2016) or scope scrapping when loopholes are left deliberately or otherwise; or the functionality of implementation is reduced based on some constraint usually. Whatever the case for such realities, mostly common with small firms with limited knowledge, process, and resources, the concomitant impact on customer satisfaction or value cannot be underplayed. Notwithstanding, some small firms do get it right from their outset though Bosch & Co. (Bosch et al. 2013) presents a worrying figure of such firms who get it right – 2%. It is worth noting that customer engagement alone cannot confer the needed impactful customer value that is sought. Hence, while attending to this, other necessary measures to address customer satisfaction, achieve organizational goal or strategic advantage should be explored. Hanssen & Fægri (2006) see benefit from CE for software firms. Jaakkola & Alexander (2014) aggregate the behavioral patterns of customers influence through engagement that can impact a firm's performance, of which small software firms are a part. Bocken, Rana & Short (2014) advocate firms adopt systemic approach towards continuity as reflected in their economic sustainability (Lago et al. 2015; Becker et al. 2015). But that cannot be done in isolation – without addressing customer satisfaction as it is only through the later the former; sustainability, can be achieved. This position is buttressed by Boehm & Sullivan (2007) who claim that the goal of any design or engineering should be to deliver added value for an investment made by a customer.

3.1.2 Comparing Customer Involvement, Participation or Collaboration & Customer Engagement

Brodie et al. (2011) laments the ambiguity that span similar relational concepts, such as participation, [collaboration,] or involvement, notwithstanding customer engagement's (CE) popularity. This is more interesting as these relational terms are enshrined in the Agile Manifesto – a rich source of most agile practices that are commonplace in software firms. Understanding them, as not necessarily interchangeable with CE, helps appreciate what customer engagement entails. Bowden (2009) explains that commitment, involvement, and trust are antecedents to customer engagement. Much as participation and involvement may yet differ somewhat – participation is active and involvement can be passive or salient, an attempt is made here to group them similarly with collaboration which likely entails either of them. Worth mentioning is that the relational concepts, per Agile Manifesto, are solely transactional – excludes pre- and post-transactional stance. Comparison or differences is presented in Table 8 below.

Table 9. Comparison of Customer Involvement, Participation or Collaboration with Customer Engagement (CE).

	Customer Participation, Involvement	Customer Engagement
1.	Ensures verification & validation	Tends towards customer satisfaction, but notably delight
2.	Customer can participate, collaborate or be involved without much experiential exchanges e.g. delegate function to developers.	Experiential exchanges are always involved (Bowden 2009)
3.	Can be, and maybe often unidirectional, bidirectional in one way e.g. B2C or C2B in any exchange	It is usually bidirectional
4.	Each can happen independently. Do not need CE per se.	Includes but entails more than involvement or collaboration as antecedents (before CE can happen). (Jiseon & Ki-Joon 2018)
5.	Usually occur within transactional	Includes all phases of relationship including pre-, and post-transaction (Kumar et al. 2010)
6.	The goal is often quality oriented and user or customer acceptance	Goal is to ensure customer loyalty, repurchases, recommendations. Chiefly customer satisfaction (or value), loyalty and growth of firm (Bowden 2009)
7.	Short sighted scope – usually with a year or during project lifespan	Last from prospect seeking, becoming a lead, to purchase and long after purchase – it is now and forever
8.	Customer is defined	Customer is blur – targets non-purchasers as well (Brodie et al. 2011)
9.	Often B2C or B2B	Can be C2C, C2B, B2B, or B2C
10.	No second chance (cost of correction) after project or product delivery	Room for multiple second chances is available; though maximally the first second-chance should be exploited

As depicted in Table 8 customer participation is not necessarily customer engagement though it is an antecedent of customer engagement. This implies that CE is much more than involving the customer or collaborating with the customer (Brodie et al. 2011). One notable point in the comparison is the fact that the definition of customer is blurred in that the process of seeking leads – those who will be interested in the software company's offering, should be treated as having value with the firm possibly incurring cost even for such provision where, 'value' is not tangibly evident. This is one grey area that proves challenging for small firms, from research, that serves as a deterrent in their engagement of customers prior to and or beyond purchase by small firms with limited resources.

3.1.3 Customer Engagement Definitions

Some definition of CE is presented with a clarification of a far-reaching meaning and implication of CE beyond what Agile Manifesto currently offers or is widely considered in most fields, pitably in software engineering in the field of research. A position that even marketing science with its plentiful research into CE still decry as cutting edge (Bowden 2009). Table 9 presented next states some definitions offered by varying scholars researching into CE in their fields.

Table 10. Definitions of Customer Engagement (CE) by Various Scholars.

Reference	Customer Engagement Definition
Zhang et al. (2016)	Psychological state of a customer's co-creative experiential exchanges with enterprises or other customers. They add that the important factors are the interactive experience and how that funnels down to value co-creation.
Bijmolt et al. (2010)	Behavioral expression of a customer towards a brand or firm that transcends [possibly post-] transaction conduct. They argue for the endogeneity of the customer; to the firm's edge in its value co-creative processes, against traditional exogenous presentation of the customer.
(continues on next page)	
Bowden (2009)	Psychological process modelling the underlying mechanisms prompting customer loyalty formation for new customers and ensuring a mechanism for continual loyalty culminating in repeat purchase for customers of a firm's offering.
Brodie et al. (2011)	'Customer engagement (CE) is a motivational state that occurs by virtue of interactive, co-creative, customer experiences with a <i>focal agent/object (e.g. a brand)</i> [Italics reference's,] in focal service relationships.' They argue that CE is central in the nomological network that govern relational exchanges of which other relational concepts, [including involvement, participation and collaboration,] are either antecedents or consequences.

Given the definitions of CE presented in Table 9 above, the earlier comparison of the antecedents which Brodie & Co (2011) referred to in their definition, in comparison to CE is better understood. Brodie et al. argue that CE is important or rather inevitable in the controlling rule that govern CE's antecedents or consequences. Also, they stress the co-creative experiences that customers feel or contribute to. Bijmolt et al. stress the transaction orientation of CE. It is argued by the author that, while the goal; no gainsaying, is transaction oriented per Bijmolt & Co., it could also be extra-transactional e.g. repair, where additional cost may be incurred, without any tangible added transactional value received by the firm — while not discountenancing added value could be anticipated. In such as the latter case, the goal is essentially customer satisfaction and loyalty without transaction being the immediate motivation. This perspective may be too futuristic for small firms with scarce resources and who seek returns quickly; only being concerned in the short-term. Hence, a need to balance this, possibly minimize cost for a small software firm is advocated. To attain this for small software firms, they could re-use components, rework the system or employ any cost-effective measures.

Furthermore, Bijmolt et al. (2010) argue for the need to recognize stages in the CE – customer acquisition, customer development and retention. These phases or stages could be likened to the pre-transactional, transactional and post-transactional phases earlier presented. Zhang et al. (2016) explain the linkage between a customer and an enterprise (provider) as consisting of three levels – **emotional, cognitive and behavioral**, in what they termed the dimensions of CE. They explain enthusiasm as the emotional component, conscious participation as cognitive, and present the social interaction emanating from the relationship as its behavioral component.

3.1.4 Customer Engagement Cycle & Process

The customer engagement cycle itemizes the possible experiential states of a potential customer from the point of first contact or connection as shown in Figure 5 below to leading a satisfied or delighted customer towards engagement. Sashi (2012) postulates the path to building CE comprise customer

engagement (CE) cycle. Sashi proposed the stages of CE cycle to include connection, interaction, satisfaction, retention, commitment, advocacy and ultimately, engagement. The interaction, Bijmolt & Co (2010) earlier explained, comprise the behavioral dimension of CE. This is the core dimension on which CE is built and as such, feeds other stages of the cycle directly or indirectly, e.g. satisfaction, [customer] retention, commitment or advocacy. Customer engagement cycle takes a rather holistic perspective of CE in that it includes non-customers (*non-transactional customers*), but includes leads (potential customers) even unknown visitors to, e.g. a small software company's web page or corporate social network.

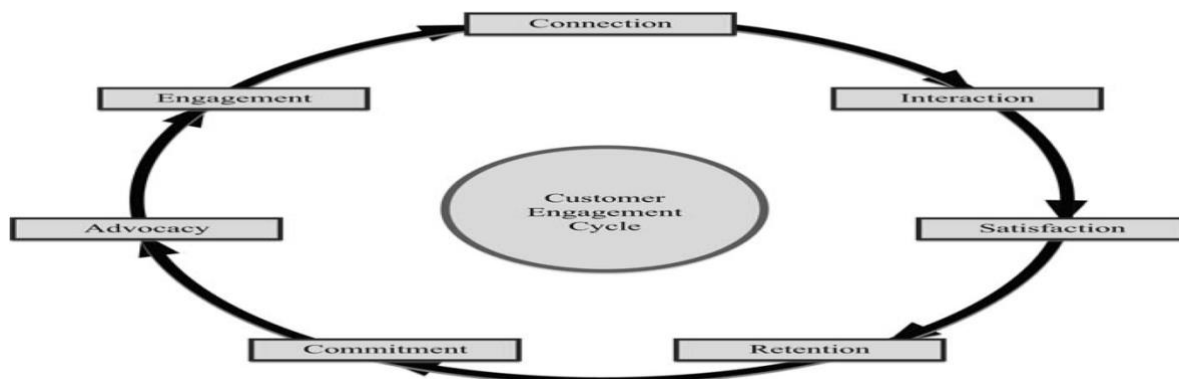


Figure 5. Customer Engagement Cycle from Connection to Engagement. Courtesy Sashi (2012).

In furtherance of the CE cycle and its constituent, much light is drawn from Sashi's (2012) *Customer Engagement, Buyer-Seller Relationships, and Social Media*. To explain Figure 5 above, each stage of the CE cycle is explained as presented below.

Connection

This is a condition for establishing any relational exchanges with a potential customer with emotional bonds. There should be a connect between provider and intending customer. Sashi adds initiating such a connection could be in-person or via digital means.

Interaction

After connection the customer has access to interact, not necessarily limited to communication, with the provider and other customers. This interaction extrapolates communication with provider to include any actor or participant; in the providers interaction space, the customer can be influenced or influence other customers in their dealings with provider. Facilitation could be through texting, virtual worlds, or [customer] social networks discussed later.

Satisfaction

The chances of a customer remaining connected is hinged on their contentment with provider or provider's services. Sashi adds that their continued interaction is also based on satisfaction, and states it is a precondition for CE. Sashi clears the dichotomy between transaction-specific and cumulative customer satisfaction with the latter accruing over time.

Retention

Continued relationship between client and provider results in repurchases or an emotional loyalty, claims Sashi. Sashi argues that customer satisfaction, but not affective commitment, positively influences retention. However, retention may have affective (high positive emotions) or calculative (long-term relationship) commitment as a consequence.

Commitment

Commitment is two-dimensional: affective or calculative commitment. Calculative commitment arises due to unavailability of options or consideration for incurred switching cost. Affective commitment develops from trust and reciprocity derived from emotions in a relationship. Sashi posit that higher levels of customer loyalty obtains from calculative commitment.

Advocacy

Sashi claims that delighted customers could either share their positive experiences in a connected world, with others via social networks or word-of-mouth about a provider, or provider's brand or product. He adds that the motivation may be affective adding that calculative loyal customers are naturally unwilling to do so, and when they do so, it is often on rational basis and at occasions.

Engagement

Sashi strongly argue that advocacy lays the foundation for engagement or CE. He adds that engagement requires both affective and calculative commitment or trust from both provider and client. Importantly, Sashi explains that customer engagement expands the role of customers by adding them to the firm's value adding process with customers as co-creators of value.

A rather intrinsic transactional perspective of CE is presented (Figure 6 below) as CE process per Bowden (2009), in that it has a transactional focus as its core. Figure 6 below presents the outcome (transactional customer) as the end goal of an interactional exchange that avails, *may not necessarily lead to*, satisfaction.

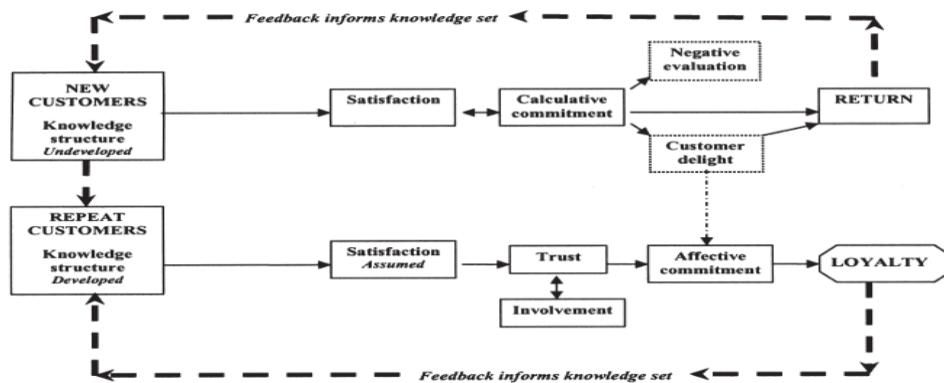


Figure 6. Customer Engagement Process from Transaction Loyalty. Reprinted from Bowden (2009).

As depicted in Figure 6 above, Bowden (2009) presents the concerted impact of knowledge structure of product or firm (brand) and satisfaction so derived from such transactional exchanges in inferring repeat purchases or gathering in advocacy for expanding customer base — adding new customers. The author differs, per Bowden's presentation on Figure 6 above, which leaves trust and involvement — on an innovation perspective — only to repeat purchases. This position may not be motivational enough for software firms to practice or be involved in good CE practices, particularly small software firms where the offering is a small set of solution suit, or single product. More so, if disposal of software system is often not anticipated, or at least in the near future. The author propose that trust, involvement, and arguably affective commitment could be earned after the first transaction a customer makes which often includes a summation of the experiential exchanges before purchase and post-purchase, besides the transactional exchanges. Worth mentioning, is the need to deepen or develop knowledge structure from a new customer during and after purchase. Trust is mostly time dependent and often earned over time, which

supports Bowden's position. But, repeat purchase may not be the only prerequisite to earn it. Hence, customer value, quality in developed product or solution and setting up an environment that support the customer's sense-making process in their value creating activities is advocated. This implies enhancing CE experiential exchanges (Zhang et al. 2017).

3.1.5 Building an Effectual Customer Engagement Environment

Building a customer engagement environment or community, is a notable medium to reaching potential customers, and for customers to advocate for firm, or on a negative not for firms; deter others from active involvement or participation. Zhang et al. (2017) claim that corporate social network (CSN) serves as a platform with which companies spread information about their offering to a large number of prospective customers (leads). Mostly, these CSNs or customer virtual environment (CVE) (Nambisan 2009) are digital environments which support seamless and unrestricted reach – B2B or B2C or C2C. Before continuing, much as CSNs or CVEs avenue, channels or platforms are beneficial, the need for face-to-face interaction cannot be overemphasized; particularly during transactional exchanges e.g. a small software company developing a product – meet face-to-face with potential users; working on a project – talk with the client (or representative frequently and possibly a subset of potential users).

Nazakat & Hong (2017) argue for the requirement engineering (RE) benefits of CSNs or CVEs. They claim that social network services have supported software firms in coping with varying limitation found in RE traditional approaches at various stages including elicitation, prioritization, and negotiation. They further add that this is timelier an avenue in catching up with the ever-changing needs of those for whom the software system is being developed – customers or users. Zhang et al. (2017) claim that to keep up with the benefits of CSNs or CVE, companies, like DELL, build corporate fan page on social media including Twitter. In today's ever competitive market place, almost every notable corporate entity has a social media presence. The motivation could be holistic CE benefit—hedonic value(emotional experiences), functional value (awareness) and social value (identity) (Zhang *et al.* 2017). As an aside, outrightly Veblen goods e.g. Ferrari® may not aim to capture all value types – likely exclude the first and last value types for the nature of what they offer. Furthermore, Veblen goods disparage Nazakat & Hong's finding on social media's usefulness for requirements gathering as only a fraction; e.g. less than one percent (1%) of 18.9 Million Ferrari's Instagram® followers (*at time of writing*), may own or ever want a Ferrari® — *know your audience*. In establishing CSNs or CVEs, transactional customers could be given a private room in such platform to timely, or even dedicatedly address their concerns given its business value priority to the firm and customer. Sashi (2012) sees the innovative value of such platforms to the firm's advantage in developing new products or enhancing new ones as the firm actively gets involved in the customer or user's value creation processes. On this note, Prahalad & Ramaswamy (2004) postulate that value holistically is moving from a traditional product and firm-centered understanding to personalized customer experiences. This new trend, argue Prahalad & Ramaswamy, is creating informed, networked, empowered and active customers who are increasingly allowing firms to co-create value with them. The network perspective is another dimension of the opportunities in CSNs or CVE which accentuates the knowledge structure of the firm's offering. However, it is not all positives or opportunities, there are potential challenges in such an environment or network which the firm may suffer from; if not effectively managed. This begs the proposition, what is the cost of building an effectual customer engagement environment?

To ensure any CSNs or CVE is effectual, it should be, at least, user friendly – easy to get by in the environment. Importantly, it should be regularly monitored for potential customer dissatisfaction reports

particularly in C2C interaction environment. On this possible flaw, it is advocated to have a dissatisfaction or concern report page or form and have a dedicated staff who manually; though can be automated, go through complaints and have them addressed — this is not bug report. Again, C2C environments should be checked often, looking for potential complaints not directly logged or reported to the firm. There is an ethical side to this – the users should be informed about this approach to ensure no ethical grievances, and that customer satisfaction or concerns are met. One area where this C2C is often evidently seen is in reviews by users or customers — this is a potent place to look out for concerns without, very likely, breaching ethical standards.

3.1.6 Customer Engagement Behavior (CEB)

Bijmolt et al. (2010) had earlier defined CE as a behavioral manifestation of a customer towards a firm's brand beyond purchase. Brodie & Co (2011) identified customer engagement (CE) as a multidimensional construct which Zhang et al. (2017) identified as cognitive, emotional, and behavioral in their three dimensions of CE. In Zhang & Co.'s exposé on CE dimensions, they did posit that the behavioral dimension encapsulates the interactional experiences which the customer is open to having. This dimension is one to explore in reaching the end of the CE cycle and ensure the CE process is fed continually with new customers (connections) and ultimately new transactions while not compromising on the core customer value that customers so derive from those transactions.

Cheung et al. (2015) strongly argue that a long-term competitive advantage is inalienable from a firm's ability to retain and expand its customer base while developing a strong engagement with its customers. The sought competitive advantage is not, in isolation, present in the customer engagement environment (CSN or CVE) of CE alone, *per se*; but all of the contributive factors that impact or influence the experiential exchange in the user's or customer's value creating process and experiences in their interactional exchanges with the firm. So, in part, if there was no potential value in the user's means of creating value, the interactional exchange e.g. CSN or CVE, irrespective of their excellence, will not suffice in delivering customer satisfaction let alone delight. In similar dimension, if there was more potential value in the user's means of value creation; the software system provided by firm, but the user is having issues with their value creation process, and cannot use the CE to get through such hindrances, the potential value so delivered will not necessarily amount to customer value or satisfaction, nor will it confer any competitive advantage on the providing firm. To mitigate this observed concern, Cheung et al. advocate a concerted effort from the software system's development process conferring its own uniqueness, while ensuring quality and taking adequate care of managing CE, including platforms or environment to motivate users to actively participate in the engagement, and interactional exchanges.

Jaakkola & Alexander (2014) see CE as an aggregation of ways customer behavior ;extra-transactional and transactional, impact the firm. Much as they decry the lag in understanding on how CE contribute to value co-creation in general, they do however, empirically see benefits including positive cognition and improved experiences, chiefly in use context. Jaakkola & Alexander further identified 4 types of customer engagement behavior (CEB) presented in Table 10 below.

Table 11. Customer Engagement Behaviours Types and Definition. Adapted from Jaakkola & Co. (2014).

CEB Type	Definition
Augmenting behavior	Extra-transactional customer resources towards expanding a firm's offering, e.g. knowledge, skills, labor or time.
Codeveloping behavior	Customer resources towards improving a firm's offering, e.g. knowledge, skills, labor or time.
Influencing behavior	Customer resources, e.g. knowledge, skills, labor or time; towards influencing other stakeholders (likely customers or leads) perception of a firm or any of its offering
Mobilizing behavior	Customer resources, e.g. relationship and time, in mobilizing other stakeholders to act towards the firm.

The table presented above gives an insight in Kumar et al.'s (2010) proposition for customer value estimation which will be discussed later in section 3.1.7 on capturing total customer value, where they propose additional parameters to customer lifetime value (CLV) in estimation of customer engagement value to the firm. These other parameters include customer knowledge value (CKV), for innovation; and customer influence value (CIV), for added or decreased purchases, perception by other stakeholders or possibly, per Jaakkola & Co. (2014), mobilizing influence — calling for a new corporate strategic approach in the firm's value proposition and potential value delivery. It should be noted that, in relation to Kumar et al., mobilizing behavior is a more active or severe form of influence behavior which usually leads to rudimental changes in a firm's approach in its potential value delivery.

3.1.7 Valuing Customer Right – Capturing Holistic Customer Engagement Value (CEV)

The previous section partly introduced the impact of a customer in the value lifecycle of a firm through their customer engagement behavior (Jaakkola & Alexander 2014). However, for a firm to understand what that means, it needs to appreciate what the value of the customer (Lehtola et al. 2009) is in context of their transactions including pre- and post-transactions. Before enunciating how to possibly value a customer aright, Jaakkola & Alexander posit the blurring line separating firms and customers as distinct entities — customers are endogenous to the firm. In simple terms, it is not, 'us against them', but 'us or we'. This perspective of viewing the customer may borrow both from Jaakkola & Alexander's customer engagement behavior (CEB) and Kumar et al.'s (2014) '**Undervalued or Overvalued Customers: Capturing Total Customer Engagement Value**'. Kumar et al. argue that customers can interact in varying ways with a firm, and that this interactional exchange or engagement, has its consequent value-creation impact. They argue; corroborating Jaakkola & Alexander's position on CEB's contribution to the firm, that valuing this engagement that arises from the interaction correctly is pivotal to an appropriate valuation of the customer.

Customer Engagement Value (CEV). As a further motivation for a [small] software company to actively engage customers in its co-creative process stirred by the customer. Kumar et al. (2014) add to the debate that the contribution of customers to a firm's value extrapolates the purchase. They argue that customer value, as seen by the firm, should be understood or addressed from the nature and extent to which customers are engaged with the firm. Expanding on Jaakkola & Alexander's (2014) four (4) dimensions of CEB presented in section 3.1.6, Kumar et al. propose four (4) core dimensions of CEV — customer referral behavior, customer influencer behavior, and customer knowledge behavior. From these behavioral or interactional approaches, each value is respectively derived.

Customer Referral Value (CRV) — how readily a customer acquires for the firm new customers. The motivation for customer referral behavior could be intrinsic to the customer, or a delightful experience. It could be extrinsic — incentivized initiative by the firm. Kumar et al. (2014) argue for extrinsic motivation.

Customer Influencer Value – (CIV) behavioral impact of customers on other customers or stakeholders e.g. word-of-mouth, leading to increased or decreased patronage or customer base. Kumar et al. claim this value dimension is intrinsically motivated. It could; in such a case, arise from value an influencer had drawn from aggregated or even single experiential exchange(s) with the firm or software product.

Customer Knowledge Value (CKV) – This, arguably; is mostly intrinsically motivated. The behavior in this case is idea exchange from the customer to the firm concerning enhancing its current offerings, or a total new product innovation. This is a behavioral pattern Jaakkola & Alexander (2014) termed augmenting behavior.

These three dimensions of customer value emanating from customer engagement, Kumar et al. (2014) maintain is often neglected for the more traditional customer lifetime value (CLV), which is entirely transaction based. They decry this practice in the academia and in practice where customer value is not a summation of customer engagement — transactional and non-transactional components. The fourth dimension, though first in Kumar et al.'s proposition, is thus the traditional and commonly used yardstick for measuring customer value — customer lifetime value.

Customer Lifetime Value (CLV) – The transactions (purchases sum) of customer less (minus) the cost to the firm for providing such unit of product or service over a period of time (lifetime) for which transaction with the customer took place as evaluated today. Kumar et al. define CLV as present value of future profits got from a customer over their life – time of actively doing business (transacting) with the firm.

To better measure CEV, ensuring these non-transactional components are taken cognizance of will be vital. Along these lines, Kumar et al. (2014) propose a summation of their proposed dimension in customer valuation as presented in Figure 7 below. The case company has a good practice of considering the engagement value of a customer (CEV) though not calculated, but estimated. In one project it developed which the author worked on, the firm considered the customer influence and referral values (CIV & CRV) in its potential value delivery, even before project takeoff.

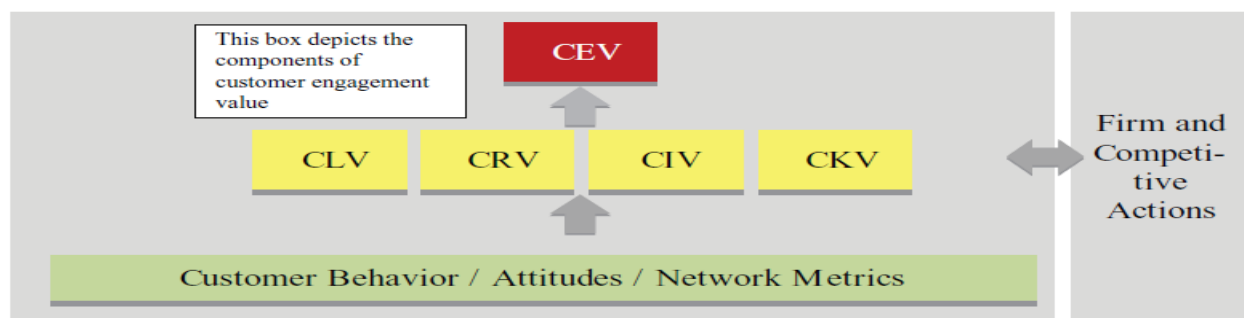


Figure 7. Capturing Holistic Customer Engagement Value. Reprinted from Kumar et al. (2014).

Some scholars argue that some of the dimension may present some difficulty in their measurement. One of such components is the customer influence value (CIV). Again, the author thinks if CRV is incentivized; a summation of the dimensions may not give the firm an edge. In such a case, it is proposed an aggregation

of the first three CEV values mentioned is stated as *incentive*, which the firm may multiply with a value less than 1 (<100%).

Reviewing Figure 7 above, Kumar et al. show the interactional exchanges between CEV and the firm's performance through its competitive activities. Interestingly, CEV does not only help the firm, it also benefits from the firm's activities. Hence, the interactional exchange should never be directed to be unidirectional e.g. towards the firm alone; the customers on the engagement divide should also benefit.

3.1.8 Customer Centric Perspectives on Customer Engagement (CE) for Software Firms

In an interactive, competitive, and dynamic environment, in which a small software firm may be increasingly challenged, customer engagement (CE) Brodie et al. (2014) allude represents a strategic imperative for accumulating improved firm performance – sales growth, superior competitive advantage and profitability. That definition or description does not appear very software engineering customer-centered — an engineering field that seeks to create value ultimately for the customer. Moreover, it is not suggested, let alone obvious, value is delivered to the customer as defined by the customer in the description; but value from the customer, as defined and appreciated by the firm.

To seek a broader and more encompassing description of the meaning of CE, Kumar et al.'s (2010) conceptualization of customer engagement value (CEV) is more motivational in better understanding CE. To expound, the customer may not necessarily be considered exogenous, meaning if the customer gets or is able to create or derive value from the firm's offering, the firm has added value from such process. Hence, any attempt or cost to enhance that process, while organizationally viable and sustainability oriented (Bocken, Rana & Short 2015; Becker et al. 2015), should be encouraged. The aforementioned pain which the firm may take in ensuring customer value or value to the customer, adds to the necessary reality that CE is not cost-free. Also, not all such incurred cost, as earlier explained, will reflect in transactional sales or revenue instantly or at any point in the near future for small firms (Carson & Cromie 1990), or even larger ones.

Customer engagement; for a firm, could be viewed as a process of accentuating customer satisfaction with the goal of earning loyalty, and growing customer base. CE gives a firm, 'many second chances' to satisfy customers and potential customers about its offering including those it did not quite get right, e.g. due to technical debt (Avgeriou et al. 2016). Having an effective customer engagement in place avails a firm the opportunity to live in their users' lived-experiences and possibly influence it. This ability to influence such behavioral manifestation is one noble and rich avenue that CE avails the firm and the customer alike. Besides, CE also implies better customer valuation and broadens the definition of customer to include 'possible', 'to-be' customers and 'used-to-be' customers. While these later inclusions do not seem to superficially add value to the firm, understanding CE from customer engagement behavior (Jaakkola & Alexander 2014) will be a further motivation to welcome these rather lax customer definitions. It is important to point out that company social networks (CSNs) or customer virtual environments (CVEs) is not in isolation CE, as customer engagement can be in place without them. Instance would be incorporating a feedback loop for user-experience or issues in software system partly has a unidirectional perspective — user does not get a tailored personalized response from such reports. In practice though, the latter, which is problem based, is often tracked which does not reflect the experiential realities as users or customers do not necessarily need have issues to see changes or improvements.

3.1.9 Customer Engagement (CE) Opportunities & Challenges – Co-creative Approach

The opportunities CE present to a firm have been mentioned in preceding section. To recap a view of the opportunities and challenges CE may present are quickly tabulated below in Table 12 below.

Table 12. Opportunities and Challenges Customer Engagement (CE) may Present to a Firm or Customer.

Opportunities	
1.	Better understanding of customer or user needs (Bijmolt et al. 2010)
2.	Gives firms avenue to solicit customer innovative ideas (Zhang et al. 2017)
3.	Gives firm room to seek improvements and build its competitive advantage with deepened customer knowledge (Vivek et al. 2012)
4.	Firms can experiment e.g. A/B testing and get timely feedback (Kumar et al. 2010; Lindgren & Münch 2016)
5.	Gives a wider reach enhancing RE gains (Nazakat & Hong 2019)
Challenges	
1.	May be difficult to segment customers which is often needed (in larger firms or customer groups)
2.	The dividends from the CE cost may not be visible
3.	Some value dimensions may be difficult to measure (Bowden 2011)
4.	Not effectively managed could lead to value co-destruction (Daniel & Javier 2016)
5.	Road mapping (Komssi et al. 2015) – returns may be visible only in long-term – small firms are short-term planners (Gardino & Abrahamsson 2014)

It is worth noting that CE allows for experimentation where timely feedback on test is readily available to the firm, even in small changes that could elicit customer responses. On competitive advantage, it should be emphasized there could be grey areas, e.g. a challenge on innovation, though this should be clearly spelt out by both knowledgeable customer (CKV) and the firm. Some scholars may argue that this does not confer competitive advantage. However, the issue with new innovation is not necessarily a competitive advantage but does include a first-entrant advantage. This could yet be a selling point for the firm.

On the challenges, the implication of an ineffectual CE such as having a customer engagement community; e.g. for a product, may malign the patronage significantly if most or any of its influential users has issues that they have not had addressed. While such communities or environment are strongly advocated, the need to effectively manage them is reverberated. Also, for small software firms, returns on investment is often a short-term goal. This may make CE not very attractive to a small software firm with limited resources. The advice on this is to expend less resources on CE projects and to adequately monitor the process & progress so obtained. This way, the financial burden on the firm is not significant to impact its economic sustainability (Avgeriou et al. 2016).

3.1.10 Impact of Customer Engagement (CE) on Value Co-creation

Customer Engagement (CE) does not only have a positive influence on customer value co-creation, but some of its component practices e.g. company social networks (CSNs) or customer virtual environment (CVE) enhance requirements engineering gains. Nazakat & Hong (2019) remark the criticality of monitoring users' feedback to know what they actually want. In their argument, they claim, staying ahead in a competitive software marketplace will continually be elusive without CE. Nazakat & Hong propose that feedback from CSNs or CVEs could be used in eliciting new requirements which can be implemented in subsequent releases. Jaakkola Alexander (2014) decry the challenge organizations face in gaining insights into the resources contributed to the organization by customers. Expounding on that, they believe

the impact of CE on customer value (CV) co-creation extrapolates the customer-developer dyad, particularly CE’s influence in customer communities or corporate environments with customer interactive medium. Notwithstanding, impact of CE’s interactive, synergetic influence on customer value co-creation is yet an evolving research area, as Alexander & Hong claim is not yet well understood. And for software engineering this could be described as yet a novel research area in requirements engineering.

Zhang et al. (2017) warn on how competitive reality for non-provision of CE environments can be costly. In such cases, they claim that customers can easily turn to close substitute providers, making loyalty, or rather using their term, stickiness, a huge challenge. If such established brands as Apple and Xiaomi — see the inherent threat and are responding appropriately, the call for small software firms to; within their means, engage their customers is amplified. More so if their offering is of a product suit, such a SaaS solution or offering. That does not dismiss the need to use CE in projects in all phases, particularly the transactional (development) through the evolution phases of the software system. This way customer value; which can be situational and durational, can be checked or responded to by the organization (provider) in being abreast with the customers’ or users’ changing needs. Besides, Bijmolt et al. (2010) claim a significant part of customer behavior is recorded in online environments. They explain that this user generated content entails a core development metric in firm-customer relationship. Hence, there is no naysaying CE can provide and help capture such an environment for customer behavioral traces through effectual customer engagement. Possibly, can be achieved using customer communities or simple social network services (Alexander & Hong 2014).

3.1.11 Summary of Customer Engagement in Customer Value Co-Creation

Customer engagement in software engineering or software business is yet a virgin island waiting to be explored. There is little research in this field. Such reality could be more far reaching for a small software firm who may have started well. The firm may have good patronage, but the user’s lived-experiences in their value-in-use context may be unknown. To care less, is likeable to discovering a much sought-after goldmine and deliberately walking past it. As Alexander & Hong (2014) noted, competitive edge or at least growth propensity and enhanced customer value, are two dividends that are associated with good and effectual CE practices. Figure 6 below characterize customer engagement (CE’s) contribution to customer value co-creation.



Figure 8. Interactional components of CE in its Customer value Co-Creation Delivery.

Summarily, the impact of CE on customer value is not unidirectional, as it could flow directly in delivering CV. Also, it could stimulate requirements engineering practices, with consequent CV co-creation (*kindly see the general summary Figure 16 for this*). At varying levels, CE can be used as the small firm develops and depending on its offering while staying within its means. By that, it is implied the small software firm should embark on CE practices aligned with its organizational goal. It is highlighted that CE does present

its own challenges, for instance, some of its practices may not be very cost effective for a small firm with limited resources – knowledge, process or fiscal. In its slightest practice, effectual CE practice is advocated for projects and products that a small software firm may have or embark on developing. Insights about developed software systems' performance and user experiences should be sought regularly – CE helps in doing this. User interaction and feedback loop could be provided for users or customers to relate their value-in-use experiences, as solely defined by them.

3.2 Requirements Engineering Good Practices

3.2.1 Overview – Requirements Engineering

Requirements engineering is a subset of software engineering that manages the real-life goals for, functions of, and constraints on; software systems (Nuseibeh & Easterbrook 2000). Nuseibeh & Easterbrook add that the identified factors and their relationship with precise specifications of how a given or desired software system should function, or evolve over time or across software families; is a core concern of requirements engineering. So, simply put, requirements engineering is a systematic approach to soliciting the needs of customer(s), or all directly or indirectly affectable by the to-be-developed software. Managing these needs (requirements), and ensuring that what the stakeholders' need have been met can be achieved via verification and validation (Heikkilä et al. 2015) through quality control measures and by the stakeholders respectively.

Some of the key phases, though can be iterative, include requirement elicitation, requirements analysis, requirements specification, requirements validation, and requirements prioritization. The details of these phases or stages will be presented shortly in this section. Quickly, elicitation involves discovering what the stakeholders want from them. Such 'wants' may be refined through requirements analysis to understand the needs or requirements. Usually, the requirements or needs are not all of equal value, though some scholars argue software obtains in a value neutral environment (Barney et al. 2008). To ensure appropriate priority is given each requirement or set of requirements based on their value, the need to prioritize them is needed. This is often done by the stakeholders' representative; the product owner (PO). Lastly, when the development team have developed and verified the developed system (tested across the board and passed), requirements engineering concerns itself with system validation to ensure the entire working software is what the customer had requested.

3.2.2 Motivation for Good Requirements Engineering (RE) Practices

The motivation for ensuring the adoption of good requirements engineering practices is not farfetched. Hussain, Mkpojiogu & Kamal (2016) strongly argue that poorly engineered requirements process contributed immensely in accounting for software projects failures. Good requirements engineering practices will not only lead to project success, but Heikkilä et al. (2015) identify benefits of good requirements engineering, as obtained in agile RE practices, to include lower process overhead and better requirements understanding. If requirements are understood better, the implementation of the known needs (requirements) are more likely to be aligned with user or customer requirements as they validate what had been developed. Notably, RE emphasizes the involvement or active participation of users or customers in the software development lifecycle including the requirements engineering phases or iterations. On that note, Kujala et al. (2005) contend that users are usually domain experts. This implies that when users actively participate; as advocated by Kujala & Co., their expert domain knowledge can be used in eliciting the requirements as they define it and as it meets their needs. Along same lines Kujala et al. claim that the most successful projects, as reported by managers, had users and customers involved.

Besides, Hofmann & Lehner (2001) report that improved requirements engineering attention given to project via investment in RE was a major boost to software project successes.

3.2.3 Requirements Engineering (RE) Process

Requirements engineering is concerned with key software engineering activities tailored towards customer value delivery, which Hofmann & Lehner (2001) identify as elicitation, modelling (or representation), validation, and verification. To ensure project success as defined by the customer per project plan, knowledge and use of good RE practices is needed. Using good RE practice without competent personnel may not suffice. Hofmann & Lehner, in their findings identified successful RE teams to have in-depth knowledge of the application domain, information technology (IT), and the RE process. Rephrasing the right combination of knowledge, resources, and process is needed. However, this thesis is scoped to at best briefly present RE process in advancing the need for good requirements engineering practices. Hence, it will not be addressing knowledge or resources. Figure 9 presented next, looks at the core components of RE process in requirements definition and change management.

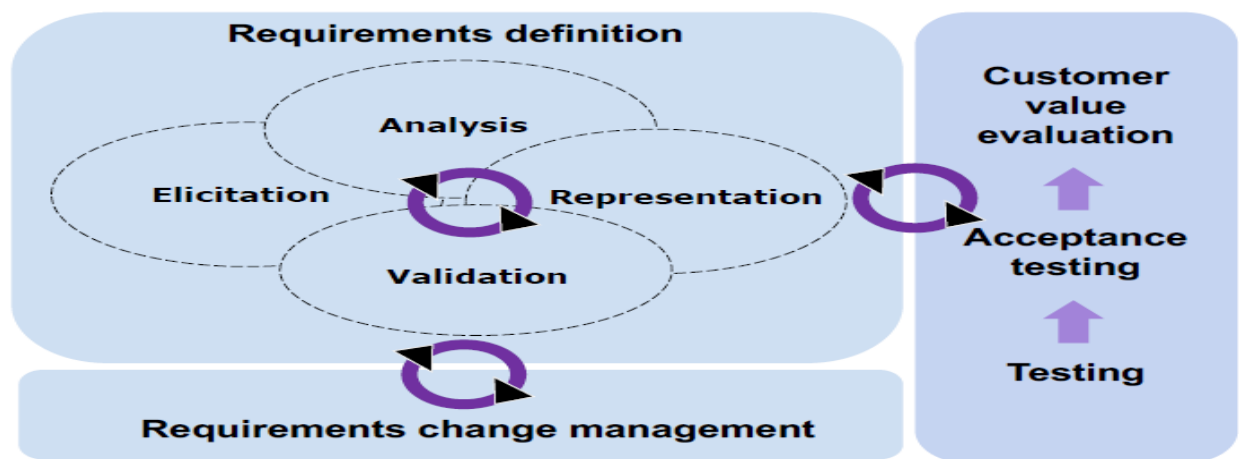


Figure 9. RE Process Model – Requirements Elicitation, Analysis, Modelling, and Validation Activities*.

*Adapted from Requirements Engineering Lecture Notes, Aalto University.

Besides, Figure 9 above gives a perspective view on testing, acceptance testing and customer value evaluation. In this thesis, the aforementioned three components may facilitate development process or be integral to them, but are considered out of scope in this thesis, while testing may entirely be in the confines of implementation or development. Husain, Mkpojiogu & Kamal (2016) posit that requirements engineering is divided into two main set of activities – requirements development; and requirements management. Per their observation, requirements development attends to the requirements definition itemized in Figure 9 above — analysis, elicitation, documentation, representation and validation. Requirements management is concerned with requirements activities spanning traceability and dynamic change management.

Requirements change management is often a concern in agile software development. The concern arises from the deliberate need, arising from varying demanding calls from customers and their ilk, in making changes to product backlog — list of requirements the product owner has itemized as to-dos. The concern is chiefly that some of these items (implemented features) are not necessarily reflected in the requirements definition, particularly in the representation. This often courses traceability issues for the requirements engineers and system evolution much later. Hence, Niazi et al. (2012) recommend using a

requirements management database (RMDB) and classify it as mandatory have for every project irrespective of its size. To achieve adoption of requirement management tools, Niazi & Co. advocate companies have a corporate change management policy that stipulates its adoption. They emphasize having a change management policy is a success factor for projects.

3.2.4 RE Elicitation Techniques

Prior to any elicitation task, preparation is often carried out. This preparation can be described as context or groundwork (Nuseibeh & Easterbrook 2000). Groundwork could include feasibility and risk assessment, and suitable process. In describing elicitation techniques, it is useful to understand some terms used in elicitation which includes, process, method, and technique. A process, in this context, per Nuseibeh & Easterbrook; is an abstractive description of ways to conduct a collection of activities describing some agents and their resource management — an instance of a process model. Hickey & Davis (2002) describe a process model as a representation of to-be-performed process in actualizing defined or expected goal(s). Method focuses on how techniques can be integrated and proffering usage guidance. Technique details how a given activity is to be performed, possibly including its notation (Hickey & Davis 2002).

RE Elicitation Techniques

Nuseibeh & Easterbrook (2000) broadly classify elicitation techniques to include traditional, group elicitation, model-driven, prototyping, cognitive, and contextual techniques, with some degree of ambiguity amongst scholars on the clear dichotomy between the first and the last methods identified. Each group is briefly presented below; majorly drawing on Nuseibeh & Easterbrook.

Traditional techniques. Employs data gathering techniques. Examples include use of surveys, questionnaires, interviews (Dicicco-Bloom & Crabtree 2006) and document analysis.

Group elicitation techniques. Exploits team dynamic while fostering stakeholders' consensus. Brainstorming, focus groups, and rapid or joint application design (RAD or JAD) workshops are good examples.

Prototyping. Used when requirements are not clearly known, have high uncertainty, or feedback is required for specification design. Often used in combination with other techniques. Can be a paper (throw-away) prototype, or a mockup design with the slightest executable implementation. Kapyaho & Kauppinen (2015) describe prototypes as executable and their purpose as experimental and for planning improvement.

Model-driven techniques. Could be goal-based method e.g. Keep All Objective Satisfied (KAOS) (van Lamsweerde et al. 1998) or scenario-based method e.g. *Co-operative Requirements Engineering with Scenarios* (CREWS). It prespecifies the model of the information to be gathered, which tailors the elicitation process.

Cognitive techniques. Combines techniques for knowledge acquisition used in knowledge-based systems. Protocol-analysis (think aloud), laddering (probe use), card sorting (stakeholders group card sorting), repertory grids (entities attribute matrix filled by stakeholders) are examples.

Contextual techniques. Alternative to traditional or cognitive techniques. It is elaborate, can be time consuming (Nazakat & Hong 2019), rich in its findings. Exemplars include ethnography; ethnomethodology and conversation analysis; and participant or user observation. It involves detailed analysis identifying trends in interactions and or conversations.

3.2.5 RE Elicitation Techniques Selection

One significant challenge with requirement engineering is how—what method (one or more techniques) or approach to use — in eliciting customer needs. To further appreciate this challenge, Kauppinen & Co. (2007) demonstrate that needs can be broadly categorized as articulated or unarticulated. As Figure 10 depicts below, needs can create customer segmentation — served and unserved customers.

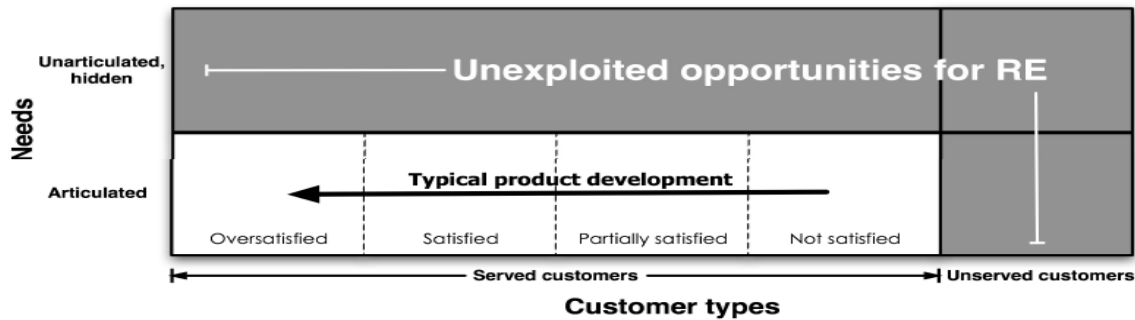


Figure 10. Requirements (Needs) Elicitation in RE from Users or Customers. Reprinted from Kauppinen et al. (2007).

Much as unarticulated or hidden needs are potential treasure trove for innovation, discovering such needs, or first what elicitation technique to use, and subsequent elicitation, is often in practice a herculean task. An aggregation of the innovation potential locking in hidden needs and the quest to minimize the unserved customer segment, are key motivations prompting acquaintance with key; possibly small set of, elicitation techniques, understanding them, and deciding which is/are the most appropriate in any given instance — project or customer determining. Motivation is more far-reaching given Hickey & Davis' (2002) warning that poor execution of elicitation will nearly guarantee the final project outcome is a failure.

On technique selection there appears to be no hard and fast rule. Hickey & Davis (2002) explain some motivation behind analyst's selection of any particular technique.

- Sole known technique
- Analyst's favorite and silver bullet technique
- Following a methodology with defined technique(s)
- Intuition on technique's efficacy in given circumstance

Hickey & Davis claim requirements engineers, with [informed] intuition, are most matured and their maturity leads to improved understanding of stakeholders' needs. They decry the lack of such informed insight in practice, which has its negative impact on project performance or outcome. This position is buttressed by Kauppinen et al. (2007) who encourage practitioners to actively discover user needs — observe them and ask them questions. It does follow from deductions that when knowledge about the customer needs is blink or scanty prototyping (Kapyaho & Kauppinen 2015) may be used in conjunction with other technique such as ethnography or user observation.

In practice, some of the most used techniques from which analysts or requirements engineers may choose from include interviews, surveys, prototyping, brainstorming, workshops, (customer) site visits, ethnography, or user observation. Brainstorming will be useful in achieving cohesion amongst stakeholders' divergent interests. Observation related techniques – observation, ethnography, protocol analysis, site visits or even prototyping – could be helpful in eliciting unserved customer needs (see Figure 10). As explained, there are no rules of thumb to follow, knowledge of each class of techniques; or each

technique; or method, coupled with stakeholders needs, and understanding of articulated needs, will be a significant indication of method or technique's outcome.

3.2.6 Requirements Engineering (RE) Practices & Challenges

This section is broadly sub-sectioned into practices and challenges. First, the practices; though more agile RE practices, are presented. Subsequently, the challenges are also reviewed as they occur in the industry.

Requirements Engineering Practices

Today, most requirements engineering practices tend towards agile development. However, some of the identified or presented practices are applicable in more traditional methods (Cao & Ramesh 2009). Inayat et al. (2014); and Cao & Ramesh (2008) identified seventeen (17) and seven (7) agile RE Practices respectively, though each included test-driven development which is more of an implementation (development) practice. Listing Inayat et al.'s recognized agile RE practices, which they claim is all-inclusive and a superset of Cao & Ramesh's, entails: face-to-face communication; customer involvement & interaction; user stories; iterative requirements; requirements prioritization; change management; cross-functional teams; prototyping; test-driven development; requirements representation; requirements management; review meetings and acceptance tests; code refactoring; shared conceptualization; pairing for requirements analysis; retrospectives; and continuous planning. In more traditional setting, detailed documentation and knowledge of the requirements; in advance, is often sought. Also, no multiple (repeated) phases of RE process, or at least not as iterative as proposed or practiced in agile requirements engineering or prioritization. However, these strict traditional practices are not quite feasible in most software projects as obtainable today.

Komssi et al. (2010) additionally identified two other practices that the list above does not explicitly contain — specification template use; and collaborative workshop; though collaborative workshop may overlap with cross-functional teams or shared conceptualization. Cox et al. (2009) suggest research supports use of good or efficient requirements engineering practices which confer several benefits including keeping with schedule and absence of product quality compromises. Table 13 underneath shows some industry good RE practices, giving each's theme and description.

Table 13. Some Requirements Engineering Practices Used in Software Industry.

	Theme	Description
1	Face-to-face communication	Reduces need for documentation (Cao & Ramesh 2008), encourages customer or user collaboration, increases user acceptance & product quality.
2	Iterative requirements gathering	More than Eighty-seven percent (87.5%) of Cao & Ramesh's participating firms in their study did not predefine requirements. Iterative requirements gathering allows for requirements to emerge. This way, requirements truly come from users or customers e.g. if prototypes are used – customers seem to know it when they see it, claims Cao & Ramesh. Thus, maximum change anticipation and management is accommodated.
3.	Requirements prioritization	Extreme in agile RE practice presenting challenges. However, allows customers to decide, select requirements with higher business value (priority) in to-be implemented requirement list, called product backlog in agile Scrum (Racheva et al. 2010; Inayat et al. 2010).
4.	Requirements change management	Adding or changing not yet implemented features; or changing already implemented features is less expensive when requirements change management is in place (Cao & Ramesh 2008). Inayat et al. claim the absence of this practice has been a huge challenge for traditional requirements engineering practice.
5	Prototyping	Help minimize error margins, and eliciting requirements that are user generated and suited; wide industry use (Kapyaho & Kauppinen 2015). The drawback may be the deployment of prototypes as acknowledged by Cao & Ramesh (2008).
6	Reviews & acceptance testing	Optimal for requirements validation and widely practised in the industry (Cao & Ramesh 2008). Reviews could be team reviews, walkthroughs, pass arounds, peer desk-checks, or ad hoc reviews. Team should identify strength and weakness of each type. (Komssi et al. 2010)
7	Specification templates	Contain predefined sections, with samples and instructions, serving as basis for documentation. On top ten RE guidelines and implementation is recommended in all organizations. (Komssi et al. 2010) It is not so pro agile.
8	User stories	Pro-agile and adopted in agile methodologies such as Scrum. Can serve as basis for implementation test driven development (TDD) (Bjarnason et al. 2015). Also, a good basis for modelling. Follows a pattern e.g. "As a [user role], I want to be able to do [activity] so I can get [business value]".
9	Requirements representation	Also called modelling requirements, aids requirement understanding across stakeholder segments. Inayat et al. claim it leaves no room for vagueness.
10	Requirements management	Per Inayat & Co., practised by customer and developing firm in keeping product backlog/features. Inayat et al. claim that in Scrum, it can be substituted for change management.
11	Customer involvement	Customers are in close collaboration at every phase of the product development or project (Inayat et al. 2014). Minimized or eliminates acceptance testing issues, though automation is seemingly used (Racheva et al. 2015; Kapyaho & Kauppinen 2015).

The themes highlighted in Table 13 above is an intersect of Cao & Ramesh’s proposed good RE practices (6) extricating test driven development (TDD), which they later removed as a RE practice in their sequel publication. Most of the practices reflected in the table enjoy wide patronage in industry, except from experience — specification template usage — though Komssi et al. (2010) argue to the contrary.

Requirements Engineering Practices Challenges

Each of the practices identified in the preceding section comes with some degree of challenge. Some observed challenges in the industry as presented by Cao & Ramesh are summed up in Table 14 beneath. The number (No) in the Table 14 correlate the practice in Table 13 above.

Table 14. Some Challenges Associated with RE Practices in Agile RE.

No	Practice	Challenge Description
1	Face-2-face communication	Customer unavailability, stakeholders’ consensus issues, developer-customer distrust can lead to poorly developed/wrong requirements (Cao & Ramesh 2008)
2	Iterative requirement gathering	No big picture (Kapyaho & Kauppinen 2015), non-functional requirements (NFRs) or quality requirements neglect, complicates cost & schedule estimation, difficulty in monitoring for manager. (Cao & Ramesh 2008)
3	Requirements prioritization	Customer defined and using only business value (Cao & Ramesh 2008). Development complexity of implementation, risk and other factors are often omitted (Racheva et al. 2010; Inayat et al. 2014).
5	Prototyping	May undermine cost and timeline estimation as customers think or do not understand why such shortly produced prototypes that look just like what is desired should cost a fortune or take years to develop (Cao & Ramesh 2008).
8	User stories	Only customer visible functional requirements are often representable (Heikkilä et al. 2015). NFRs or quality requirements are often vaguely stated or left out altogether, a huge setback in making architectural decisions (Firesmith 2007).
9	Representation	If used as requirement management tool, NFRs are total left out as they cannot explicitly be modelled, though may be implied or known.

The observations presented in Table 14 above record findings in application of these practices. It does not imply a total boycott of the practice but calls for intuition and tradeoff in their application based on what architectural decisions (Klein 2016) are considered important. For instance, if a critical application for airplane navigation were developed, all requirements may be well spelt out or at least prioritization may not have to go extreme. Another key observed challenge remarked by Komssi et al. (2015) is fragmented knowledge, which arises or manifests in communication with stakeholders, e.g. different customer segments with varying perspectives on same topic. Communication over such a group will be daunting to convey and misunderstandings increase.

3.2.7 Agile RE Practices – Benefits, Problems, & Solutions

This subsection presents benefits of adopting good requirements engineering practices in software development life cycle (SDLC). It reflects or relates the practices itemized in section 3.2.6 and highlight observed benefit from each practice’s use. Subsequently, it looks at some problems and solutions in some practices. Problem, in this context, is separate from challenge in that it may not respond to any approach currently targeted at it in surmounting it, or may completely elude practitioners — how to approach it if recognized. However, some problems may relate to challenges or appear as challenges or vice-versa.

RE Benefits

Each RE practice has its attendant benefit as itemized by Cao & Ramesh (2008). Some benefits from using good RE practices as earlier highlighted in section 3.2.6 above are as reflected in Table 15 below.

Table 15. Some associated Benefits of Using Good RE Practices.

Practice	Benefit
Face-2-face communication	Make project or development more customer tailored, obviates time spent on detailed documentation and reduces associated fiscal cost.
Iterative requirements gathering	Customer satisfaction increases, clearer requirements, and both customer and developer firm are on same page.
Requirements prioritization	Meets customer business needs, increased customer satisfaction, and development team expend resources in high business value requirements. Both parties are more fulfilled with achievement.
Req. change management	Change is usually slight alterations or tweaks, less expensive to implement.
Prototyping	Reduces communication gap, allows for timely feedback and better requirement specification. May have component template for skeletal implementation take-off, though reuse of executable prototype code is highly discouraged.
Team Reviews	Provides stakeholders update or progress. May help resolve challenges e.g. ad hoc review (Komssi et al. 2010)

Other benefits or related to those recognised by Cao & Ramesh are summarised quickly subsequently. The coalescing effect of using good requirements engineering practices as proposed by Heikkilä et al. (2015) include: **Lower process overhead** — Minimizes reworks in addition to benefits already identified by Cao & Co. (2008). **Improved requirements knowledge** — Draws from benefits of practices 1 & 2 from Table 14. **Reduced overallocation** — Estimations are better made – scarce resources adequately and efficiently allocated. **Responsiveness to change** — Agile RE practices are change welcoming unlike traditional RE practices. **Rapid Value delivery** — Value can be monitored and iteratively delivered with quick validation update. **Improved Customer relations** — The rapport between provider and customer is enhanced and communication can be more fluid. Outcome is increased value delivery as defined by customer (Komssi et al. 2015), with a reciprocal implication.

RE Practice Problems

Firesmith (2007) observed a total of twelve (12) nagging problems in requirements engineering practice in the software engineering industry. The theme around these problems identified are:

1. poor quality of requirements;
2. simplistic use case modelling overemphasis;
3. inappropriate constraints;
4. requirements traceability;
5. requirements omission;
6. Excessive requirements volatility leading to unmanaged scope creep;
7. Inadequate non-functional requirements (NFR) or quality requirements verification;
8. Poor [functional] requirements validation;
9. Inadequate requirements management;
10. Inadequate requirements process;
11. Inadequate tool support; and

12. Untrained requirements engineers.

Heikkila et al. (2015); Cao & Ramesh (2008); and Avgeriou et al. (2016) decry traceability issues emanating from user story challenges; detailed requirements specification; and code and architectural design (Klein 2016) respectively. Heikkila et al. identified six (6) problems including: *user story limitation, technical debt growth — Firesmith’s unmanaged scope creep, dependence on analyst’s tacit knowledge, communication with client representative, extreme prioritization, and lack of precision in effort estimation.*

User stories are limited in that only functional, visible activity are often requested, or explicitly stated by customers. They often assume quality requirements are obvious (Avgeriou et al. 2016). Technical debt refers to a deliberate or indeliberate omission of requirements or their partial fulfilment with the prospect of repaying (implementing or fulfilling them) at a later time. When requirements are omitted, with technical debt in view or not, it is called scope creep (Firesmith 2007). Analyst (or requirements engineer) tacit knowledge — expert personnel with good training on requirements engineering — is required and such knowledge is not easily transferrable (Heikkila et al. 2015). Client communication can be a problem when customer or client has no dedicated personnel to function as product owner (PO) in projects, onsite or offsite. Product owners are client representatives who manage product backlog earlier explained, and ensure stakeholders’ business goals are maintained or upheld. Extreme prioritization can negatively impact architectural design (Klein 2016), or portray unrealistic duration or cost to client. This occurs when prioritization is solely on business value as defined by customer Heikkila et al. (2015).

Six (6) of Firesmith’s RE practice identified problems will be discussed next. For details of the other six (6) or the entire twelve (12) identified, you may read Firesmith’s (2007), **Common Requirements Problems, Their Negative Consequences, Industry Best Practices to Help Solve Them.** To discuss the problems, they will be paired alongside the solutions. Enunciating the problems to be more elaborate and detailed, requires a table is not used. Hence, next subsection RE Practices Problems & Solution has details.

RE Practice Solutions to Problems

Poor Requirement Quality. Firesmith criticize ambiguous, incohesive, incomplete, incorrect, outdated, or lacking requirements. The adduced problem here is the consequent impediment of increased cost and propensity of overruns — budget and schedule. **Solution** — train analysts to recognize good and bad requirements. Also, Firesmith advocates inspection though most agile practices are not pro-inspection.

Inappropriate Constraints. Firesmith propose the removal of unnecessary requirements irrespective of their support function. He claims requirements are often belittled with an avalanche of constraints specified as requirements. This arises from analyst’s limited knowledge of implementation outside the common or popular ones. He decries the lack of domain knowledge or lack of foresight by stakeholders in the to-be designed system’s possible improvement. Problem is it prevents better solution implementation or selection. **Solution** — Common knowledge of stakeholders of constraints check and specification should be more of ‘how’ rather than ‘how’ and ‘to what extent’.

Traceability. Much as traceability importance is widely known and stressed in training, Firesmith (2007) acknowledges in practice many requirements are not properly traced. To reiterate traceability, in this context, entails the one-to-one mapping of functional (or other) requirements to architecture or design elements. Problem is lack of trace leaves knowledge of proposed or actual change impact hugely unknown. **Solution** — adopt organizational traceability policy. Firesmith advises requirements tracing be made mandatory in contracts and requirements engineering method should explicitly state its practice.

Omitted Requirements. Overlooking architecturally significant requirements (Klein 2016) can be critical to system scalability limitation for instance. The problem is it is nearly impossible addressing, or later consideration has its consequent cost implication if ever feasible. **Solution** — use of good methods such as modelling the state to elicit implication of all foreseeable inputs and request are catered to under all conditions (Firesmith 2007).

Poor Requirements Validation. A significant task for analysts is to ensure stakeholders completely and correctly specify their requirements. Heikkila et al. (2016) decry the limited access to stakeholders and Firesmith adds that this is a major cause of requirements validation problem. The consequent problem is incomplete requirements — acceptance is low, project is failed or at least challenged. **Solution** — Firesmith strongly warn that validating requirements be made a basic component of all requirements methods used by a firm, despite resource limitations. This should be reflected in the project plan's budget and schedule.

Inadequate Requirements Process. Hofmann & Lehner (2001) acknowledged in 18 firms studied only some had RE process in place or tailored it to their specific need. Firesmith claim that inadequate documenting of RE activities, as evidenced in practice, is a RE practice concern. The problem identified is inconsistency in specification by requirements engineers (analyst) creates difficulty for architects, designers, developers and testers in their core functions. This problem results in budget and schedule overrun with delivery of defective systems inundated with missing functionalities. **Solution** — Experience and collaboration is advocated. Firesmith claims experienced requirements engineering and process engineers can team up and a complete method is used — all components: tasks, techniques, roles and responsibility; and work products. Furthermore, Firesmith adds that project specific RE method could be constructed from scratch, possibly using commercial tools such as RUP (Rational Unified Process) from IBM, or open source tools.

3.2.8 Identifying High Perceived Value Requirements Engineering Practices

Cox et al. (2009) argue that to enhance RE process, practices that should be encouraged must enjoy patronage via its practitioners perceived value. They claim some practices, with high perceived value, can lead to improved RE process and deliver business value.

Based on the RE process states, phases, or stages; highly perceived value RE practices may be stratified. Per Niazi et al. (2012) three levels of abstraction are obtainable: requirements documentation practices, requirements elicitation practices and requirements management practices. Table 16 below presents each category, and the high perceived value RE practices it entails.

Table 16. High Perceived Value RE Practices presented by Category of Practices.

Practice Category/Practice	
Practice Category — Requirements Documentation practices	
1	Use a defined standard document specification structure (Komssi 2010; Niazi et al. 2012)
2	After elicitation add a summary of the requirements (Nuseibeh & Co. 2000; Niazi et al. 2012)
3	Present the project or system with a business case as motivation for backing (Niazi et al. 2012)
Practice Category — Requirements Elicitation Practices	
1	Asses system feasibility, background or context. (Nuseibeh & Easterbrook 2000; Niazi et al. 2012)
2	Define operation domain or environment (Niazi et al. 2012)
3	Use business objectives, besides client’s business value, to drive elicitation (Barney et al. 2009)
Practice Category — Requirements Management Practices	
1	Ensure change management policy is defined and followed — avoid scope creep (Niazi et al. 2012)
2	Set out whole system desirable properties — global system requirements (Niazi et al. 2012)

Table 16 above, highlights some of the most widely used RE practices by RE process phase. The listed practices are not the only ones used. There are other categories such as medium or low perceived value practices. If curious you may see, ‘*An Empirical Study Identifying High Perceived Value Requirements Engineering Practices: Advances in Information Systems Development: Bridging the Gap between Academia and Industry —pp 731-743*’ by Niazi et al. (2012). In a research these practices have been reported to have wide patronage as their perceived high value is allude to by respondents in a study conducted by Niazi & Co. Requirements management practices had two high perceived value RE Practices which reflects its importance in the entire RE process; though not categorically in the main RE process’s four (4) core activities, but furnishes the activities, as Figure 9 depicts.

3.2.9 Summary of Good Requirements Engineering (RE) Practices

Requirements engineering, as a branch of software engineering, plays an important role in ensuring the project succeeds. Besides, its role is not entirely for the customer but seeks the success of the firm as it delivers on its value proposition through effective requirements gathering techniques and practices on the pledged customer potential value. It is important to note that good RE practices, or ensuring their usage, requires some attitudinal change or organizational shift which most large companies do not like to be involved in given their complex nature. That does not exempt a small software firm, particularly if they have in place established ways of running their operations. One motivation for seeking understanding and adoption of good requirements engineering practices is to actualize, on the long term, the organizational sustainability and feasibility of the firm, more so in a very competitive marketplace. Figure 11 below gives a synopsis of good requirements engineering practices contribution to customer value co-creation.

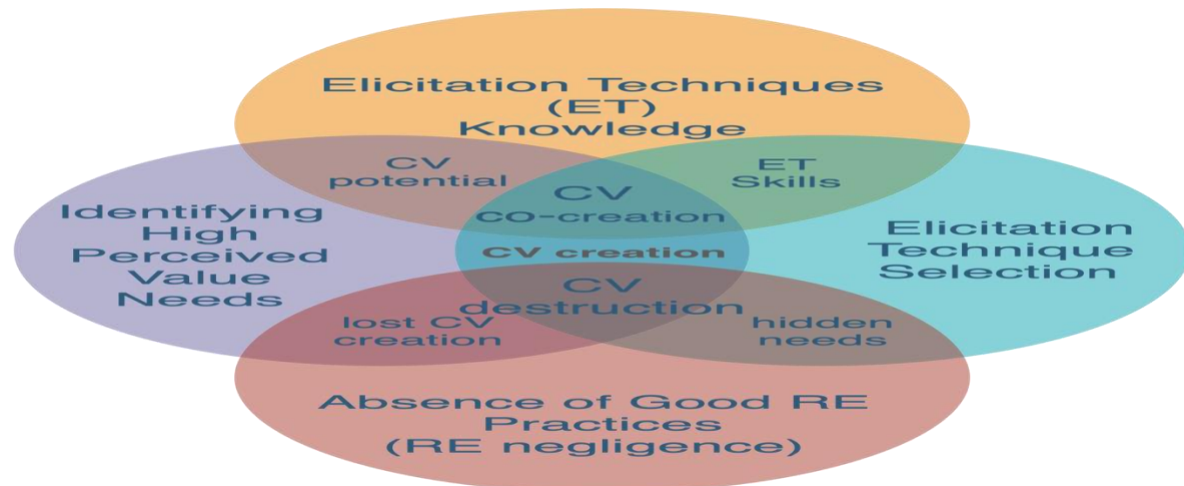


Figure 11. Key Drivers for Customer Value Co-Creation Delivery through Good RE practices.

The impact of good requirement engineering practices; or motivation for its introduction, entails benefits that could accrue to provider firm likewise, customer, in their strategic and business objectives actualization. The RE process reflects the key conceptual stages; though presented separately, are closely knitted in actualizing specification per customer requirements. The challenge with the process, as presented, is often in the elicitation stage. This was motivation to look into elicitation techniques (see Figure 11) and approaches to select them to ensure they were productive or effectual — producing the results for which they were sought.

Subsequently, more elaborate RE practices, reflecting the modern trend—agile practices, were presented alongside their challenges. The practices hallmark included user or customer participation, user or customer centered requirement elicitation, and value from the customer’s perspective just as value for the firm was considered. The challenges were shown to be manageable. Additionally, benefits of good RE practices were significantly discussed. Moreover, problems encountered in RE practices, their consequences, and solutions to circumvent them were presented.

Lastly, motivation by firm on adoption of good RE practices were presented as perceived value based. Also, the categorization of these practices was given as RE process’ elicitation activity coupled with documentation and management of requirements. This could also be a motivation advocated for small software firms with scarce resources. Such practices, those more adequately known, should be explored to know what benefit locks or locked for a similar project, though no two software projects can be exactly the same. Figure 11 above depicts the co-creative contribution of usage of good RE practices, and absence of good RE practices is presented as having detrimental impact on customer value creation — customer value co-destruction.

3.3 Customer Value Co-Creation

This category of the thesis’ research question 2 will briefly review and present customer value from yet additional perspectives buttressing what other categories; CE and RE practices, had already described. First, it presents a view on a user — becomes important in value creation per use-context which may be different from a customer. Next, it looks at the definition of a customer, possibly differing from; rather a subset of CE’s view of a customer. Again, it attempts to answer the question what does value means? It goes afterwards to define customer value, and reviews the value co-creative process in small software

firms. Lastly, it presents characteristics that could impact the value co-creative process for both client and providing firm as is evidenced in a competitive and dynamic market as software business.

3.3.1 Who Is a User?

User, per Dictionary.com (2019), is one who exercises the right to enjoy a property [, product or service]. Another definition of a user proposed by Dictionary.com is, 'A person who uses [a thing — tangible or intangible]'. ISO 9241 (2010) describes a user as one who interacts with a given product. On a curious note, one may be interested to know what constitutes the 'right to enjoy' or confers it on a user. The author holds such right may be attributable to a customer — one who pays for the services or software system used by the user — as next subsection 3.3.2 presents. With this knowledge, the author argues for the customer empowering the user (*possibly to the status of co-customer*). Importantly the user is highly influential in determining what constitutes value in the value co-creation triad (firm-customer-user).

3.3.2 Who Is a Customer?

Customer, as defined by the Merriam Webster Collegiate Dictionary (2019) is, 'One who purchases [or pays for] a commodity or service'. The definition above gives a transactional description of one who engages with the firm's focus offering. In this case one who buys a company's product, or have a paid subscription to their service offering. This perspective of a customer may be a motivation for considering the customer as exogenous to the firm — a widely held concept; claim Bijmolt et al. (2010). This perception quickly excludes the engagement contributions of customers to firms' organizational objectives (Kumar et al. 2014). Notwithstanding, for the purpose of this thesis, it is forgivable to presume that users are superset of customers — they use and pay for the product or service.

Much as user concern or satisfaction should be strongly considered in a firm's value proposition or potential value delivery, it is however, the customer (or user *where they are a superset of customer*) who is the closest source of value discovery or judgement. By that, it implies: how much value a software system has can best be ascertained through the customer's (in)dependent value judgement. The concern solely for users' satisfaction arises in that the customer's perceived delivered value chiefly includes an aggregation of the software system's end-users' derived utility. So, the call for customer value is not only to ensure majority of users derive value-in-use in their use-context of the software system, but positively influence the customer's value judgment also through non-use-context. Such value elicitation could arise from experiential exchanges, customer engagement, or whatever confers competitive edge on the firm.

3.3.3 What Does the User Need?

Given the software system is essentially developed for the user, it is imperative the system engineer; possibly customer and provider stakeholders, know what the system's users' needs or requirements are in addition to other requirements e.g. technical requirements. Understanding user needs, requirements or attending to knowing them is pivotal in obtaining user satisfaction (Gaver et al. 1999; DiCiccio & Crabtree 2006; Osterwalder et al. 2015). Millen (2000) claims these needs, or requirements are not well understood by computer system [or software] engineers, or experts in developing the requested systems. Understanding the user better may require field research using various research techniques including semi-structured, structured or unstructured interviews (DiCiccio & Crabtree 2006; ISO 9242 2010), ethnographic studies or use of probes (Seamann 1999) and questionnaires (Boynton & Greenhalgh 2004). Of the available research methods, if no resource limitations — time, reach, or fiscal — Boynton & Greenhalgh warn that use of questionnaires be critically evaluated before commencement — they may not be the best of alternatives. Further details on research methods was presented earlier in section 2.2.

3.3.4 What Is Value?

Barney et al. (2006) claim that in software industry many practices are carried out in a value neutral setting. This implies that requirements are often treated as equally important (Alahyari et al. 2017). Predicting the value of software is an upheaval task (Alahyari et al. 2017; Dingsoyr & Lassenius 2016). Dingsoyr & Lassenius claim that improvement trends that have influenced software development of late are business value focused. Barney et al. (2006) claim that marketing science perceives value as relationship that exist between the needs of a customer and the products offered or derivable benefits tailored towards the needs. Barney & Co. (2006) add that consideration for all stakeholders in value assessment is crucial. Looking closely at a key concept in this thesis; customer value, management literature considers value as determined by the customer from two perspectives — absolute value: extent to meeting a customer's need; and relative: benefits it offers compared to available alternative solutions. Barney et al. (2006) contend that anytime [a software] system is said to have value is when or if it is useful, convenient or essential. Along those lines, provider organizations when creating *potential* value may do so in different dimensions such as economic, physical, emotional, social, cognitive or political.

Barney et al. (2008) relates that economic theory presents value as customer loyalty earned from satisfaction or delight with a possibly consequent repurchase behavior. They propose three aspects of value — product, customer's perceived, and relationship; values. Product value, they claim is price relative to quality attributes derivable from the software product's usage. Perceived value by the customer is pre-usage, or ownership defined. As Barney & Co. (2008) expound, it is the price a prospective customer is willing to pay in exchange. Mathematically, it is a ratio of perceived benefits to perceived price with each measured relative to close substitute offering. To further explain the pre-usage stance, Barney et al. (2008) argue that perceived value is influenced by customers' needs, expectations, past experiences, and culture. The relationship value is created from experiential exchanges between customer and the product software company and cannot exist outside the product and or customer perceived value (Barney et al. 2008).

3.3.5 What Is Co-Creation?

Ramaswamy & Ozcan (2018) posit that co-creation is enactment of interactional formation through system-environments powered by interactive platforms, constituting defined or changing roles for each experiential participant or actor. The formation or creation of interaction constitutes an exchange across actor or participant roles. The formation contributed by each actor is inherently value oriented for itself and the interaction recipient. The interactional participants or actors, each contributes to realize complementary benefits in a collaborative process (Prior & Marcos-Cuevas 2016).

It is strongly argued by Jaakkola & Alexander (2014) that co-creation can be enabled through customer engagement in enhancing business performance. However, the discuss is not unilateral — attending to firm performance alone — includes ways to elicit or better understand the user or customer activities, and aids in their value creation process. Prior & Marcos-Cuevas reiterate that the co-creative processes do not necessarily imply service or product exchange but an exchange of activities including experiential exchanges. They further warn that such a process could be destructive, in what they termed 'value co-destruction'. To better understand that; they explain that value co-destruction is interactional — each participant contributes to it in varying measure, unlike value destruction (*service failure or product harm*), which is unilateral.

3.3.6 Defining Customer Value (CV)

A bargain is supposedly achieved when a customer’s perceived value from purchase of a given software system is greater than the cost of purchase. The software firm naturally sees a transaction as being of value — value of or from a customer — if the cost of development is significantly less than the price paid by the client. Wohlin & Aurum (2005) claim that for software firms, the returns (profit) on sold units constitutes the perceived or derived value. Almquist et al. (2016) suggest that customers weigh a product or service’s offering on its perceived price and the asking price. Barney et al (2007) contend that developing products or services that meet customer requirements, concomitantly offering high value which provides a degree of guarantee of market success will be a huge success factor for software companies. While Barney et al.’s (2007) approach appears to be that of proffering a solution, Almquist et al. (2016) posit the challenge is usually eliciting or knowing what customers truly appreciate, explaining it is difficult to isolate and complicated — knowing the problem or need. But what is the motivation to look out for customer value? First, value can be stratified at higher levels. Almquist et al. (2016) explain that these stratifications could be generalized as functional, emotional, life changing (transformational) or having a social impact. Figure 12 below exemplify the varying classes of value as proposed by Almquist et al.

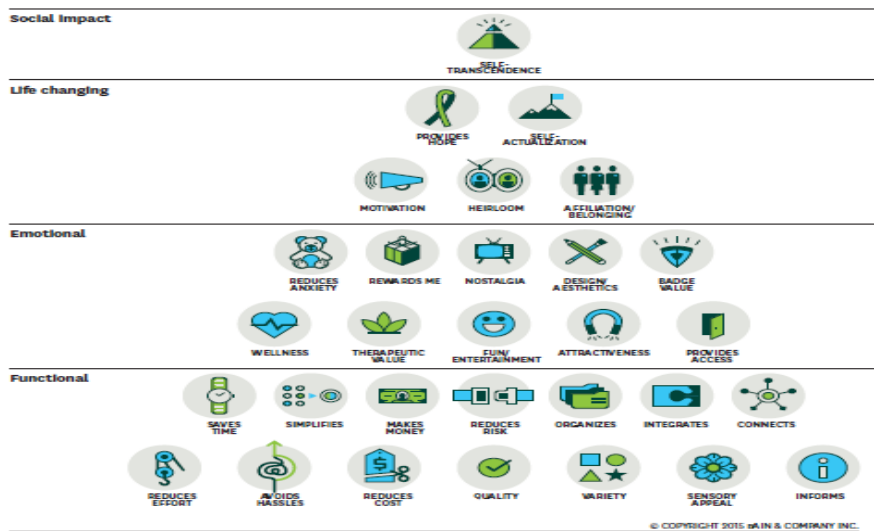


Figure 12. Value Stratification with Its 30 Elements Pyramid. Reproduced from Almquist et al. (2016).

The pyramid presented in the value categorization above (Figure 12), the majority of the 30 elements are mostly functional or emotional — accounting for 80% of the elements. Ability to tailor and identify user or customer needs along these classifications may present a first step in the right direction regarding developing solutions that could possibly meet customer expectations. It is important to add; there is no demand to fulfil or meet majority of the elements in each level nor a call to meet unrequired element so as to cover all the levels so presented. Simply put, if the elicitation process reflects ‘saves time’ and or ‘avoid hassles’ for the application to be developed, there is no call to unnecessarily cater to ‘integrate’; though ‘quality’ may be an indispensable functional value element, which could be added with the client’s approval or knowledge — cost implication. Excluding ‘quality’ as a functional element, even if not directly elicited as a requirement, may have its negative consequences for the software firm (Almquist et al. 2016). For details of the pyramid presented in Figure 12 above, kindly look up, ‘The Elements of Value’ by Almquist et al. (2016). Besides, the elements of the pyramid presented could be used in the software company’s offering in its value proposition.

3.3.7 Value Co-Creation in Small Software Firms

Value co-creation or customer value co-creation is a bidirectional value creation context where customers, with developing firm, create customer value. Its bidirectional approach entails there is value for the firm in customer value as much as value is essentially to the customer (user). A customer (or user) entirely creates their value. Importantly, the developing firm can facilitate, contribute potential value resources or influence the customer’s value creation process. Notably, co-creation involves interactional exchanges at varying strata between customer (or user) and firm. Prahalad & Ramaswamy (2004) assert that a firm cannot create anything of value without the engagement of its customers or users. This explains that interactional exchange is inalienable in the co-creation process. Value creation is a means of service definition, argue Lenka et al. (2017) who explain that value co-creation can only occur through interactional exchanges between provider and customers in the customers value creation process. Lenka et al. further contend that when value is strictly created (*not co-created*), value creation exclusively happens in the customer sphere and the joint sphere (see Figure 13 below) where customer, with provider, engage in joint value creation.

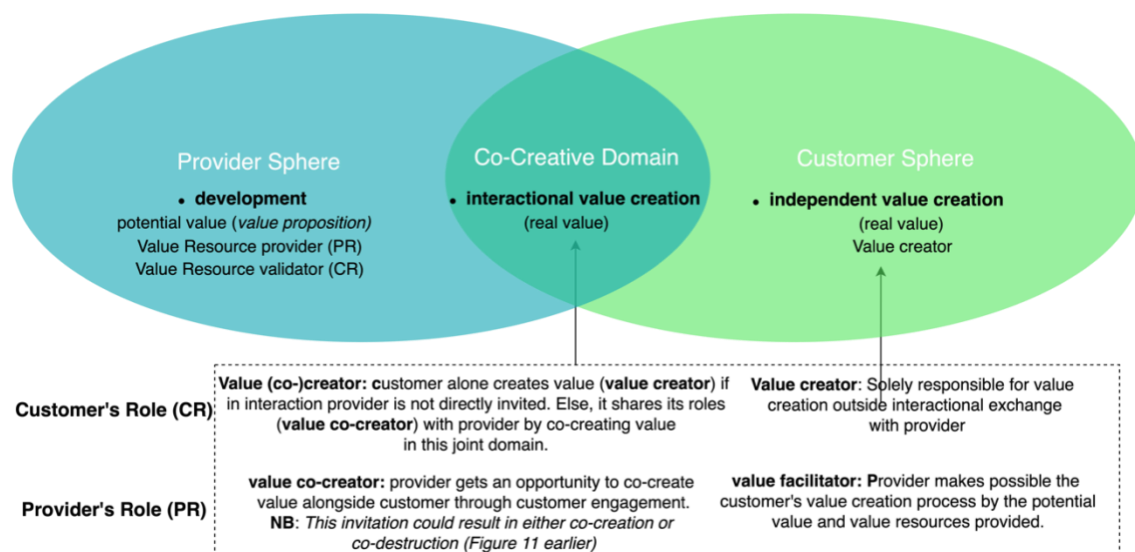


Figure 13. Value Creation Sphere Showing Where Value Is Co-Created. Inspired by Grönroos (2013).

Mikkonen et al. (2016) explain that value co-creation is taking place when a customer [or user] is interacting or using the service so provided by a firm. Reypens et al. (2016) first introduced the need for a network effect or a platform to facilitate value co-creation. Mikkonen et al. argue that such ecosystem is beneficial for value co-creation. Mikonen et al. explains that such platform allows for the gathering of external competences which are enablers for value co-creation. Furthermore, the confines of the co-creative process are broader. Mikkonen & Co. explain that the customers are part of the construction of such boundaries going beyond just management. Reypens et al. (2016) explicate the need for co-creative space explaining that no individual organization owns all required expertise, knowledge and credibility required for developing innovative software solutions in meeting today’s complex and scientific challenges. This explains that co-creation, though outside the context or scope of this thesis, could be multi-stakeholder approach including B2B context in industry benchmarking in addition to B2C or C2B exchanges. Ekman et al. (2016) presents co-created value as emergent, implying co-creative process participants’ roles may change with time as their co-creative involvement differ. See Figure 14 below on how the roles could be influenced with changes in involvement or participation in value co-creation.

Grönroos (2013) strongly argues for value creation as being in the exclusive domain of the customer, while not dismissing the *potential* value or impact of the provider in influencing the customer’s [or user’s] value creation outcome.

	Provider	Beneficiary
Active	Engage (Initiate/Drive)	Engage (Respond/Receive)
Passive	Participate (Allow)	Participate (Observe)

Figure 14. Value Co-Creation Participants' Varying Involvement. Adapted from Ekman et al. (2016).

Little Todd (2004) explains that for software firm’s value delivery, or assessment of performance for potential value delivery, parameters that are to be considered include staff effectiveness, rework time, value created, value captured and resources. Little explains that team’s productivity and their size will determine their effectiveness. The relative time to fix defects (bugs) to development time give an indication of the required time, while the effective development time compared to assumed value could be inferred as the value created. Little further adds that time relative to delay cost conveys the captured value. Little’s model on internal potential value assessment could be a good indicator in risk management e.g. is it feasible to finish a given project in six (6) months with the resources a firm has, what could be the captured value? Proffering appropriate answers to these questions could assist in better project planning. If firms ensure their internal processes contribute to the value co-creation dyad; beyond barely working software, the dividends for the firm and customer will likely increase.

3.3.8 Summary of Customer Value Creation & Co-creation

Customer value defined as the user’s or customer’s experiential (or obtained) value-in-use excludes the providing firm’s essential software requirements gathering and development from [customer] value creation process (Grönroos 2013). Grönroos’ position is premised on the exclusivity of value creation in the domains of the customer or user. However, provider firm does contribute potential value or value resources used by the customer in value creation. Therefore, the firm arguably, is an active [customer] value resource contributor in the value co-creation dyad. At an interactional level, customer with provider, through exchange, co-create value. The position of customer-centric value creation does not negate or dismiss the firm’s contribution to the value creation process of the customer. However, it vehemently denies customer value can exist before a user or customer interacts with a software system. Simply put, customer value is an outcome of software system use by a user or customer. Grönroos notes, corroborating earlier findings, customer value co-creation is reciprocated value creation by firm and customer. Figure 15 below gives a descriptive summary of customer value and its co-creation.

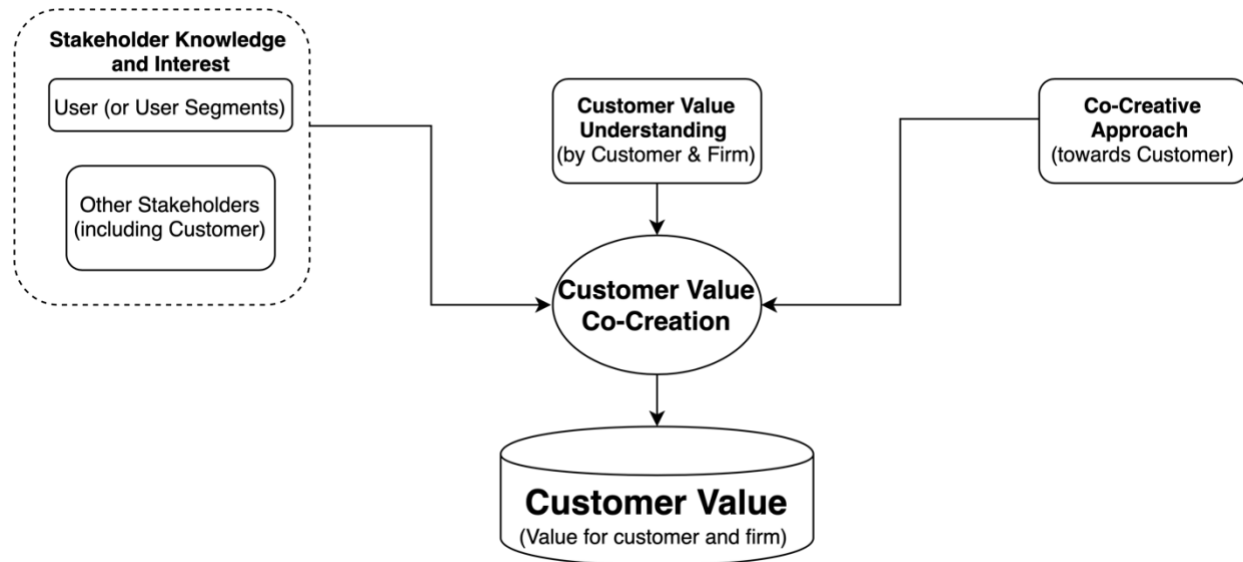


Figure 15. Customer Value Co-creation with Business Value for Customer and Provider Firm.

Customer value, per Figure 12 page 44, exists in defined stratum. The lower the value element in the value pyramid the far reaching its goal and the more sought or fundamental the challenge or problem it solves. The challenge is not often meeting these value elements as needs but eliciting them from users or customers who arguably have no full knowledge of them prior to 'seeing' or 'relating with' them. This often makes the puzzle more challenging and may lead to addressing concerns or developing features which users do not need or add little or no potential value or value resource for value elicitation from use by users. Understanding what customer value is; what the customer/user really needs and providing a system that meets those needs, is crucial and the most effective potential value creation approach contribution by firms to the customer's or user's value creation process. That said, customer value in its broadest sense seeks the good (or benefit) of both firm and customer. Hence, customer value is reciprocal in its creation (co-creation) and its delivered value (or business value) is to both customer and firm. This is essentially what 'value' means for both firm and customer. Per Figure 15, customer value co-creation is a contributive channel for customer value accumulation which is served by all stakeholders. Figure 15 also demonstrates the role of the firm is significantly pivotal in customer value co-creation.

Importantly, customer engagement in the joint sphere; per Figure 11, is a huge pool for investigating the customer process, while contributing to customer value creation and co-creation. A major and notable use of CE and the joint sphere, using Figure 11, could be to know the customer or user's use-context, unmet needs, or pain points and tailor solutions in those directions. Chiefly, this process of enhancing the potential customer value delivery and the customer value co-creative process does require good requirements engineering practices.

3.4 Systemic Literature Review (SLR) Summary — CE, Good RE Practices & CV Co-Creation

Positive influence of customer engagement is directly and indirectly impactful on customer value or its co-creation. Good requirements engineering practices can be chiefly enriched by customer engagement. Customer engagement and good requirements engineering practices can each serve as a conduit through which the other influences customer value co-creation as depicted in Figure 16 below. Figure 16 graphically demonstrate some of these impacts, whether directly or indirectly.

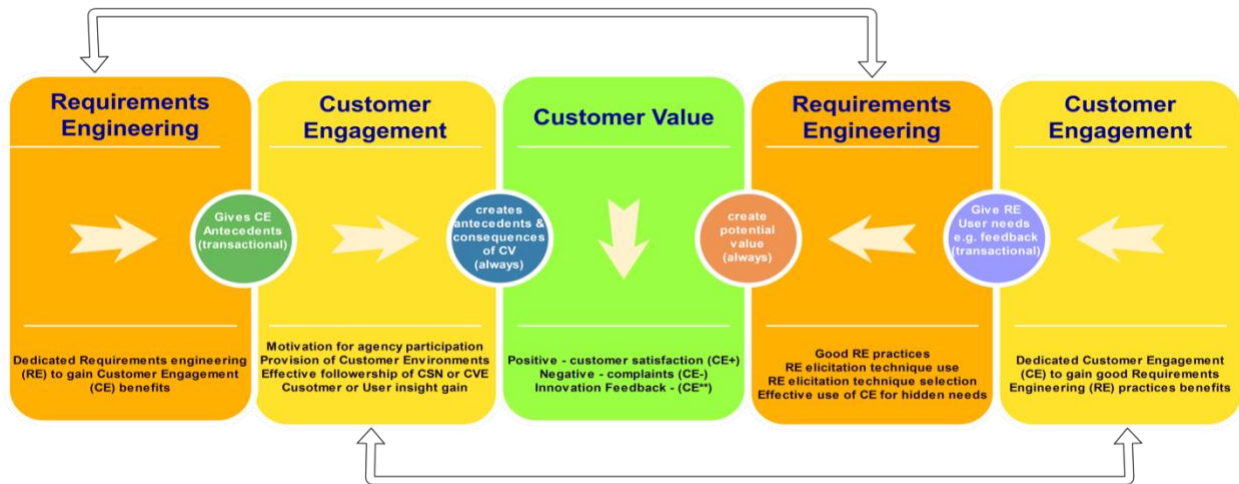


Figure 16. Relationship between customer engagement, good requirement engineering practices and customer value.

Customer value as presented in Figure 16 above, once created is retained, meaning at a higher dimension impacts both the customer (*or user*) and providing firm. Another view from Figure 16 is that sometimes customer engagement needs good requirements engineering practices for its influence to be felt. Same is applicable to [good] requirements engineering [practices] —may need CE, in delivering its customer value benefits. Figure 17 subsequently presented does not significantly explicate the details of the co-creative process. However, Figure 18 presented afterwards illustrates the co-creative contributions of both customer and firm.

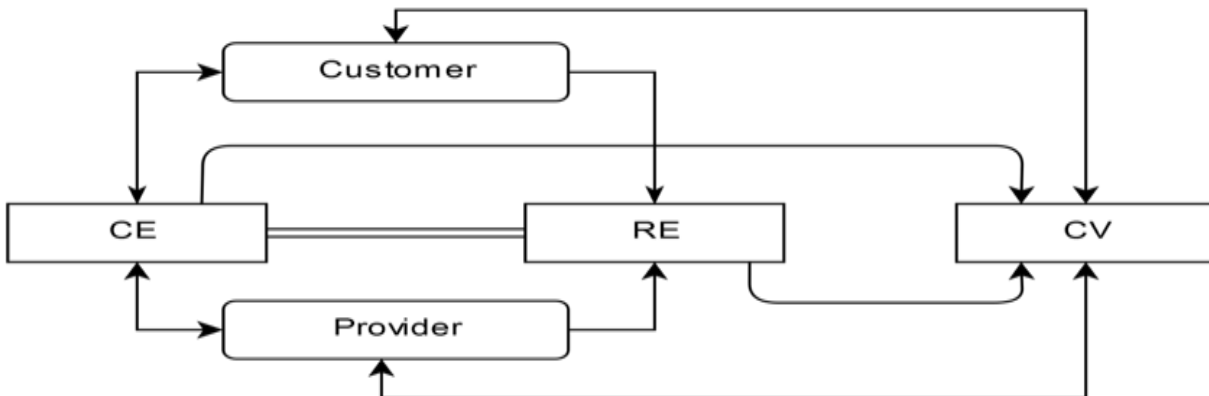


Figure 17. Impact of Co-Created Customer Value on Customer & Provider Firm.

Customer value (CV) is a source of business value, at least, to both customer and firm as shown in Figure 15 above. The bidirectional arrow connecting either customer or provider firm to CV indicates the co-creative contributions of both customer and provider in customer value co-creation, even as they each draw benefits from CV. Given the great details of relationships ensuing from the Figure 17 above, Figure 18 presents more analytical and detailed relationships in an annotated diagram.

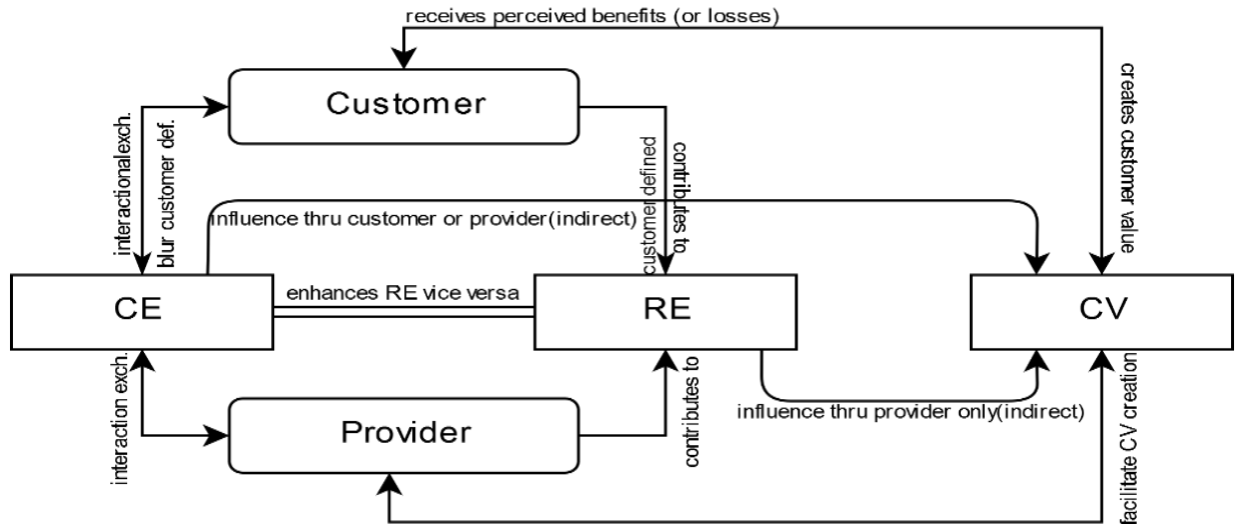


Figure 18. Customer & Provider Impact by CE, Good RE Practices and Customer Value — annotated.

Summarizing customer value (CV), it is created by the customer derivable in the software system so procured through interaction or use. For a software firm, CV extrapolates profit to include business value accruing to a software firm from the development or provision of a software system and its eventual usage benefits to customer over time. Value can be evaluated from different dimensions —economic, social, physical, political or emotional. The price relative to its value-in-use defined by attributes from utility so drawn, together with perceived value for which the customer or user purchased; or is using the software system, are bases for a relationship value that ensues between the customer and software firm.

4. Empirical Study Results

The goal of this chapter is to answer the research question one (RQ1) of this thesis which is stated below.

RQ1: *What customer engagement (CE) and requirements engineering (RE) practices are in place at the case company?*

Before answering the RQ1 per practices in customer engagement or requirements engineering practices, the chapter first builds a basis or foundation for the practices from the empirical study. Hence, the practices emanate from the foundational discoveries or learnings based on the empirical evidence got from the research. Also, it presents findings directly related to customer value co-creation. Also, it reports interesting results.

4.1 Customer Engagement

To build or better understand and validate customer engagement practices in research companies, the foundational premises or learnings are presented in this section. To enunciate that, this section presents three tables (foundations; practices; Benefits & challenges) and sets of explanations. For each table in this section, 'Theme Remark' implies the researcher's comment from the empirical study on that theme so discussed.

4.1.1 Foundations for Customer Engagement Practices

Firstly, empirical evidence suggest customer engagement (CE) practices are understood from these dimensions or themes — general CE perspectives, customer engagement value, customer engagement environments, customer engagement perspectives (views and knowledge), and collaborative practices. All these are presented in Table 17 below. Table 17 presents major observations under each theme which are briefly itemized. Each theme; alongside its learnings (reflections), is explained in details after the table.

Table 17. Foundational Facts Contributing to CE practices from Empirical Studies.

Theme	Learnings	Theme Remark
Customer engagement value (CEV)	<ul style="list-style-type: none"> • CEV awareness emerged on its own without planning • CEV is complex to assess for a startup • CEV was chiefly based on project/product fiscal value 	Not deliberately considered possibly due to complexity.
Customer Engagement Environment (CEE)	<ul style="list-style-type: none"> • CEE used only for client during project development • CEE benefit awareness was substantive in case firm • CEE observed to be client-tailored, if client provided • Provider had no dedicated CEE for users or customers 	CEE is used only in development per project, product or individual customer
Customer Engagement Perspectives	<ul style="list-style-type: none"> • CE was significantly seen as important in case company • One of CE's cycle stages; advocacy, was most desired • CE brought improved project duration understanding 	Importance, benefit and need well-articulated.
Collaborative Practices (CP)	<ul style="list-style-type: none"> • Collaboration may be burdensome to some customers • Customer type variation was apparent & influenced CP • Communication with direct customers was high 	CP may reduce CE to just antecedents e.g. collaboration

Customer engagement value

Customer engagement value (CEV) implies the potential business benefit derivable from a customer. Understanding CEV as summative or its assessment is considered novel but not yet practiced. Sources explained that no consideration was initially given to CEV but it emerged naturally and was often along

the lines of the fiscal (monetary) value of a client's project(s). Assessing CEV was seen as a novel thing to do, but a given startup's limitations, the complexity it portends was lamented by a respondent. *"We do not calculate those [CEV] per say. Of course, we do the calculation of: how potentially viable their continued relationship would be with different projects [customer lifetime value (CLV)]. But we don't do separate actual calculations. It is kind of — it would be smart but on the other hand it is a small company — you know the situation quite well when you were in here."* Possible other factors that could influence CEV not considered include a customer's ability to influence (*positively or negatively*) other customers or potential customers — customer influence value (CIV); their innovation resource — customer knowledge value (CKV) and their referral capability — customer referral value (CRV).

Customer Engagement Environment (CEE)

There is considerable awareness of gains of an environment for customer engagement; whether customers or company (*or corporate*) social network (CSN) or customer virtual environment (CVE). CEE use is evolving in intra-project communication. The use in projects is visibly exemplified in a respondent's assertion, *"Now they [dev team and client] have been using Microsoft Teams®. That is something we have not been using before and we share all the materials with very large group of people."* However, pre-transactional (*during time of scouting for potential customers or connection*) and post transactional (*subsequent time after project completion or delivery*) considerations are not in place. Also, awareness of need for CEE and its benefit in pre- & post-transactions was stated. And importantly user (or customer) interactional channel about user experiences was sought by sources. When environment existed for interacting with developer firm used by a client, the client usually provided such a channel, which is a good practice for in-project communication and interaction though developer could initiate such provision as well. When asked if they had CEE channel dedicated to (potential) customers, a source stated, *"No, not yet. That is something we kind of know there has to be that kind of channel."* As explained, dedicated CEE for users or customers will be needed; as case company is actively considering implementing it though resources — manpower and fiscal considerations — are a major hindrance.

Customer Engagement Perspectives

Customer Engagement was explained as vital for its role in increasing customers base, growth and sustainability. Hence, its importance is noted. Another perspective was more exact or specific which hinged on advocacy, as a source made explicate: *"It [CE] has been actually very good. So, the small discussion we had before the recording [started] you were saying actually getting the customer to work as your advocate: that is something that has been very critical to us."* This practice of seeking advocacy by ensuring potential value is developed in useable product yielded dividends: *"... . We also make good products [and projects]. So, we often get customer advocates as well"*. Viewing it from customer interaction, a perspective shared explained that customer engagement helped in better project duration understanding. With more projects and interaction with clients, provider firm personnel garner experiences better positioning them to forecast project timeline.

Collaborative Practices

Customer Engagement (CE) collaborative practices is multifaceted. Some customers are more actively involved than others as a choice or as their practice. For more passive customers, they consider participation a burden they are unwilling to bear. Also, the customer type variation was seen to influence project outcome. *"There are different customers. Some customers want to be really involved hands-on even in code level. And then for some, there are cases such that customer [en]trusts you with most of the decisions."* Lax on passive customer type was problematic and often jeopardized project success

elucidated a respondent, “It is really difficult, it is a tricky thing, because that [delegating most functions to developer] only works when you manage to do stuff what they like. That only works then, and that is not always the case.” Communication (or customer involvement) increased with projects having direct customers — “But with direct customer in projects We are always in contact with our customers.”

4.1.2 Customer Engagement (CE) Practices

There were 4 well established customer engagement (CE) practices identified at case company. The CE practices at case companies identified from empirical evidence are presented in Table 18 below.

Table 18. Observed Customer Engagement Practices in Case Companies.

No	Practice	Explanation
1	Customer segmentation	Depending on any of importance, needs, availability or business value customers or users may be divided into segments. This help serve each target group better and tailor services to meet their needs.
2	Customer Co-creation Platform	Customers could be given room to contribute to used product e.g. by customizing their application to better suite needs. Co-creation channel could be integrated to users’ channel or separate. Availability could be before or during product use. More importantly, room for new product ideas, and innovation, alongside provider should be encouraged.
3	Constantly Learn from Users	For innovation and product improvement users are important. Continuously learning about users’ [interactional] experiences is one of best practices.
4	Prompt Feedback Redress	Address customer/user concerns targeted at provider directly or indirectly. In more established firms’ CE practices, can be delegated to other users and incentivized. In case company it is addressed with an internal approach — attending to purchasing customers’ query.

Some practices not yet evidently or tangibly practiced or those recommended in addition to those in Table 18 above are presented next in section 4.1.3 below.

4.1.3 Additional Practices — Recommended & In-Progress Practices

Some practices in the case company are still in their formative stage as they are being worked on. Such practices are represented or footnoted with (*) superscript. Those not currently practices but recommended are superscripted with a plus sign (+) as demonstrated in Table 19 below.

Table 19. Recommended⁺ & To-Be-Improved^{*} Customer Engagement Practices in Case Firm.

No	Practice	Explanation
1	Devoted Users Channel⁺	Dedicated channel or platform should be created for customer or user groups to facilitate other CE practices e.g. interaction (<i>see practices 4 table 18; and 2 below</i>) amongst customers or users. When a product is targeted d to customers with end-users this should be a dedicated customer channel
2	User-2-User interaction⁺	Allowing User-to-User (U2U) or customer-to-customer (C2C) interaction creates a dynamic momentum should could be explored by the provider, or participants individually or collectively. Hence, if the provider is not prepared to manage or provide practice 5 below this practice could be delayed.
3	Use of Incentives[*]	Voluntary participation in customer engagement by users can be strengthened. To minimize self-centered participation particularly with customers (or users) who otherwise would not join, giving incentives — bonuses, discounts, points or other recognition — can be an edge.
4	Broadened Customer View⁺	Implies giving <i>potential</i> customers resources e.g. time, attention, responses even when the feasibility of their becoming purchasing customers is still hazy. It could also include broadened valuation of customer engagement value. The Challenge is often ‘forestalling waste’ by eliminating least rewarding practices — uncommon practice amongst startups due to scarce resources.

In Table 19 above, practices 1 & 2 appear similar — interaction very likely needs a channel to operate; but are quite distinct in that U2U or C2C channel can exist without an interaction amongst users or customers. This difference can help in forestalling any co-destructive tendencies an environment for users may portend when adequate provision is not yet available for practice 4 in Table 18 above.

4.1.4 Challenges & Benefits of Customer Engagement Practices

Lastly in this section, the challenges and benefits encountered in CE practices by practitioners in case company is presented in the Table 20 below. The details presented reflect pains in CE practices and benefits that sources recounted.

Table 20. Identified Challenges and Benefits from Customer Engagement Practices by Practitioners.

Theme	Learnings	Theme Remark
CE Practice Challenges	<ul style="list-style-type: none"> Customer unavailability; often in B2B setting is a worry Customer expectations are sometimes not realistic Passive customer participation is often a challenge 	Centered on communication & participation
CE Practice Benefits	<ul style="list-style-type: none"> Advocacy, with better SW market knowledge is gained Better estimation & customer knowledge are achieved Product/project visibility is enhanced via collaboration 	Increase customer base, and customer satisfaction

CE Practice Challenges

From level of implementation of CE practices some challenges practitioners encountered include unavailability of customer—hinders customer participation; customer expectations are unreasonably high or not feasible; passive customer participation which hampered productivity and general project success, and working culture differences. Explaining some of these challenges, a source recounted, *“And people are so busy especially in B2B sector. It is very hard to get that time allocation.”* On workplace culture difference, a responder decried the pain this brings, *“Working cultures are different. That is always one thing. People are used to different types of approaches, and not necessarily that accustomed to, for example software development. ... software development isn’t usually an 8-4[pm] type of work.”*

CE Practice Benefits

Benefits of CE practices are seen in advocacy, better estimation derived from increased [transactional] customer engagement; customer knowledge gained from engaging with customers of varying type; provider’s product increased visibility, better customer understanding, and software marketplace understanding. Advocacy at CE level encompasses all sources use e.g. word-of-mouth, or person-to-personal advocacy outside the U2U or C2C environment provided by the firm. It is a far more reaching form of advocacy that captures value beyond a customer environment. Also, more software (SW) market knowledge is gained by practitioners including those with no formal training in the field with increased CE. CE during projects can confer experiential knowledge that could be vital in other areas. One such area explained a respondent is in project estimation, *“And also, doing lots of projects you kind of get better idea of how much time something takes. Time is really difficult thing.”* Furthermore, *“Well, obviously it [customer engagement] is kind of [complex]. We have done lot of projects. And [had] lots of different customers. So, ... you kind of much better understand the marketplace”*, explained a source.

4.2 Requirements Engineering

Requirements engineering practices are more established practices in a small software firm; as empirical evidence shows. To explicate requirements engineering practices at case company, a premise or foundation substantiating the practices is first presented with tables and explanations in section 4.2.1. Afterwards, section 4.2.2 answers the RQ1 in part along the lines of RE practices.

4.2.1 Foundations for Requirements Engineering Practices

In elucidating possible practices in requirements engineering at case company, empirical evidence suggest elicitation techniques have a huge role to play. Also, requirements gathering — requirements and its gathering process knowledge was recorded as important. Besides, customer complexity was added as a determining factor. These themes are presented in table 21 below, and subsequently detailed explanations in this section are given. It is from these tables and explanations that the requirements engineering (RE) practices at case company are presented to answer the research question (RQ1) per RE practices.

Table 21. Foundational Bases for Good RE Practices at Case Company.

Theme	Learnings	Theme Remark
Elicitation Techniques	<ul style="list-style-type: none"> • Narrow in elicitation technique(s) & their selection • Blur line across traditional & iterative process exist • Considerable upfront prototype use is evident • Requirements are defined too early on (predefined) 	Narrow spectrum and high-level use – early in the specification phase mostly or only
Requirements Gathering	<ul style="list-style-type: none"> • Requirements definition stages may be unspecified • Statement of requirements sometimes poorly done • Some good RE practice knowledge visibly evident • RE process knowledge appeared unenforced 	Well defined & stated at high-level. Not iterative for projects with unclear needs .
Customer Needs Complexity	<ul style="list-style-type: none"> • customer needs often emerges with time in projects • Customer needs were unpredictably changing • Some customer needs were hidden & hard eliciting • Customer’s lack of technical knowledge affect planning 	Customer delineation: iterative – has <i>some unknowns</i> ; and traditional– all known.

Elicitation Techniques

Findings in elicitation techniques explicate possible narrowness in organizational elicitation techniques – there may be a few techniques to choose from or their specifications or use implication in a project are not well understood. Lack of clear dichotomy between traditional (waterfall) and iterative (agile) processes may be present – same elicitation techniques and process do not necessarily apply for both: they require different approaches for project success. Also seen was considerable upfront prototype use and requirements predefinition which mitigate requirements emergence needed particularly in iterative development projects. For more traditional projects, the elicitation techniques scope appears to suffice, but lags behind in keeping up with change for iterative projects. An interviewee explained on use of prototype that “*So, during the sales process, we show them different examples [samples or prototypes] of something we have done earlier ... or some other references*”. The use of prototype is highly encouraged as it helps the customer to ‘*know or think of*’ what they want. On predefinition of requirements, an interviewee explained “*So, we can actually do it in let’s say do it in an hour. We can already body – how the product should be.*”. Expounding a respondent explained it can be more detailed, “*... . We usually have meetings –specification meetings, and then we take that topic into discussion.*” One respondent explained how customers present their requirements, “*They have already done their own investigation and it is like: Can you really tell them you know better their businesses what is better for them?*”

Requirements Gathering

On gathering of requirements, deduction include requirements definition stages may be unspecified which could influence the veracity of the elicited requirement. Statement of requirements – clearly stated at higher level and for traditional (waterfall) process but suitability for iterative development is impacted by its being unspecified. Good RE practices demonstrated include use of prototype, particularly in virtual reality – an ecosystem case company operates. Additionally, requirement management is ad hoc or at best informal as a respondent enunciated, “*But then managing the projects from the direct discussion is too often: the main lines are just in my head per se, which I am then doing forward in the projects. But it is all ... kind of works because we still have project group sizes which are still small.*” Also, a need for RE process knowledge is evident. Furthermore, a respondent recommended improvement in RE practices for

managing and gathering requirements as they are not so well specified yet but *persona* guided – “So, it is often very *persona* guided.”

Customer Needs Complexity

Analyzed data suggest *customer needs complexity* may be an area of concern and exploration for case company, particularly, in emerging technologies such as extended reality (XR). Some of these concerns manifest in emergence of needs as a project progresses; or changing customer needs, which is challenging to predict. Besides, hidden customer needs which presents a challenge to elicit; and lack of technical knowledge by customers, which negatively influencing negotiations for provider as complexity is not often understood or appreciated by client, was identified. While changing needs helped customer get a product that is useful, it does demand more from the provider as resources allocated may change making them incur added cost. A respondent explained requirements importance even when emergent—may inadvertently produce good results, “Sometimes you might get an amazing result not knowing [the requirement]. For example, using heuristics or trying out an idea [options]: Ok this might work. For example, we did one project and we used the photogrammetric modelling and picture projecting technology that we were not sure was going to exactly work. But it ended up really nice and worked really well. But it turned out that project was an experimental project from the get go.” On changing and hidden customer needs respondents explain, “Almost every time we start a project, we do not know the problems. There are many unknowns” and “Too often the customer needs seem erratic but it is not”.

As with most practices in any software engineering field, challenges do arise alongside benefits. To demonstrate some of the challenges encountered, empirical evidence from case company gives bases for some challenges and benefits expounded in Table 22 below.

Table 22. Data Analysis Findings on Challenges & Benefits Encountered by Practitioners in RE Practices.

Theme	Learnings	Theme Remark
Requirements Engineering Practice Challenges	<ul style="list-style-type: none"> Requirements are poorly stated Eliciting requirements & ordering them is complex There is too much focus on features too early Time based estimation & technical debt challenge 	RE Practice challenges span RE process grasp elicitation techniques, or feature adornment.
Requirements Engineering Practices Benefits	<ul style="list-style-type: none"> Better RE practices confer higher success likelihood better customer understanding is got via RE practice Enhanced customer communication & management Projects easier to management with good practices 	RE practice benefits has positive influence on customer satisfaction levels.

RE Practice Challenges

Some challenges identified by practitioners in case company include poorly stating requirements, eliciting requirements [that translate into customer value creation], too early features refinement, basing estimation hugely or solely on time, and technical debt. “So, it is like challenges come when there is misunderstanding with the stating requirements and stating requirements quality levels”, explained a respondent. On stating requirement challenge, “So, knowing what the customer actually needs again and prioritizing what the customer needs”, stated a respondent; though prioritization may be entirely the client’s task, could sometimes be challenging. Focus on features too early detract from keeping track with the big picture—project scope. A respondent enunciated that tradeoffs (technical debt) are incurred in difficult situations or when requirements are not effectively managed, “And in the end, we found a way

that was some compromise between quality and lighting quality and shadows. It was a really complex case. That was a very good lesson of the challenges.” Use of chiefly time-based estimation may have its challenges decried a respondent, *“We always approach the budget through time, which is kind of silly. But in the real [world outcome may not always be what we desired].”*

RE practice Benefits

Benefits with good requirement engineering practices identified by practitioners in case company include project or product higher success rate, better customer understanding, enhanced customer management or communication, and easier project management. Respondents stated increased project success was attributable to use of good RE practices. Projects or products are likely to succeed, *“Because then you do not have to validate them [again and again]. There is less surprises for the customer and from the customer.”* Also, the customers are easier to work with, *“For the next project [obviously], to know how to approach this sort of or kind of customers. And how to actually try to manage the customers. Though I do not like the term: to manage customers, but it is something you will still have to do.”* Lastly, a respondent added, *“The better you manage the customer requirements from the start the easier the project is.”*

4.2.2 Requirements Engineering Practices

Findings from the research present seven (7) requirements engineering (RE) practices in case company as depicted in Table 23 below with explanations.

Table 23. Key Requirements Engineering Practices in place at case company.

No	Firm Practice	Explanation
1	Prototyping	Use of already developed products from past projects, or references in eliciting requirements from customers is significantly a common practice in case company particularly in extended reality (XR) sector. Additionally, the use of prototypes should aid customers in stating what they want, and not necessarily persuade them wanting a reproduced 'prototype' product.
2	Face-to-face communication	While a good practice, it is sparingly used in agile projects e.g. customer contact may be limited to 4 times and usually at beginning or end of development. This approach may undermine the goal of the practice – reduce need for extensive documentation and increase customer satisfaction.
3	Customer involvement	Customer involvement or collaboration is considerably practiced. Practice is influenced by customers willingness and project size. Practice greatly influences project success or customer satisfaction.
4	Requirements Change Management	Not institutionalized but emergent practice – it occurs as change is necessarily accommodated in iterative development projects. The cost of extreme requirement changes and ways to manage it were identified. Also, need to have more formal approach to handling change was considered important.
5	Requirements management	Evident in company practices but still has <i>ad hoc</i> outlook as stated in Foundations for RE Practices. Case company working towards more formal requirements management possibly using a requirements management database for instance.
6	Continuous Planning	A good and evident practice. Case company embarked on road mapping for product and services. The challenge for startups may be in its naturally short-sighted outlook. Having a balance view between time and resources may help manage this practice better.
7	Detailed Documentation	There is considerable use of documentation in startups more so in extended reality (XR) sector. This practice while most advocated for waterfall kind of project e.g. the military equipment manufacturer customer project cited by a source, it may not be the best for iterative projects.

Table 23 above gives details of RE practices as obtained at the time in case company. There was no practice not yet significantly in place or regularly practiced, save for requirements (change) management — still emergent and *ad hoc* respectively as Table 23 details. Also, these practices were on ground and used regularly or at defined routines e.g. heavily at some points in project or less at other point or as defined by the project team.

4.3 Customer Value Co-Creation

The influence of customer engagement and requirements engineering practices on customer value co-creation is central to this thesis theme. Besides, customer value co-creation, while viewed on its own, could bring benefits (dividends) independently. Gains from CE or RE practices can be funneled to customer value creation through channels, like usage feedback, to better meet client or user needs — though

practitioners may have opposing motives for gathering data. Hence, Table 24 below enunciates, at a glance, customer value foundational learnings.

Table 24. Customer Value Impact from Empirical Data Gathered.

Theme	Learnings	Theme Remark
Customer Value (CV) Dividends	<ul style="list-style-type: none"> CV consideration gives customer sense of ownership CV focus gives all stakeholders business value Ensuring CV consideration from start minimizes cost 	Minimize waste, find bases for progress and satisfy customer.
Usage Feedback Motivation	<ul style="list-style-type: none"> Main motive is to attract investors or know user size Feedback aid learning about business value to client Passive legal ethical observance may be profounder 	Explicate startups' motivation for data gathering & benefits
Co-creation Perspectives	<ul style="list-style-type: none"> Holistic organizational view is either B2B or C2C Co-creation may give product enhancement stream Competitive advantage may be obtained – not a goal Network effect achievable with co-creation 	Expanded co-creation is presented: Everyone including provider is a customer–B2B or C2C.
CV challenge	<ul style="list-style-type: none"> How to use feedback data in improving product? 'Doing too good job' leads to losing the big picture Intellectual resource demand can be huge 	Joining data analytics to enhance product; human resource cost.

4.3.1 Customer Value (CV) Dividends

Most benefits that are adduceable to customer value (CV) also draw from CE and good RE practices. While focusing on CV respondents cited some dividends to include customer sense of ownership, business value derivable by stakeholders, avenue to seek honest feedback, and cut cost (*though incurring additional cost is possible*) through early use of good CE & RE practices. To elucidate sense of ownership, a respondent stated, *“And we want to make kind of sure from the start that clients feel the project is theirs. So, it is not like it is something that is given to us and we work and when we are done, we just tell them this is done; here you go.”* An interviewee, in clarifying stakeholders who are recipients of business value, made it even reflexive, *“Again, depending on the project. It should be all. The customer value main beneficiary should be the customer. That they would directly get the value. But it is always ‘you get’; you used the term co-creation again. So, in a way, we are also our own customers at the same time. So, we are getting the value also.”* Ensuring use of good practices in delivering customer value may help avoid unnecessary rework (or refactoring) which is a major source of waste or added cost.

4.3.2 Usage Feedback Motivation

Analyses of qualitative data from research shows that there are two main reasons why small or startup software companies gather data. It could be to attract investors as claimed by a respondent, *“No, no. For a young company, there is [are] different motives why gather data. One, our strategy is not such that we would collect huge amount of data from our customers to actually attract investors. That is one of main line of strategy in small or startup companies.”* Additionally, a second or the other identified motivation centers on user amount relative to the ecosystem or market in which a startup or small software firm operates. A respondent explained that their motivation is: *“So, our numbers are more user amounts; because that is kind of related to the whole ecosystem or user market.”*

Other findings regarding feedback is that it serves as a rich store to learn about customer value creation and business value so derived by customers and end-users which tells how well the provider has

performed in the product development. *“For example, on the other side there are other cases especially with those museum or science center visitors. The feedback from them has taught us a lesson; it really has been useful for the clients and it really has met expectations and it is a worthwhile point for them to invest in VR paying tens of thousands of euros for that.”* Analyzing user experiences and customer value got from usage of developed software gives avenue to know about the derived customer value which is important to provider (*case company*) and customers alike; ensuring end-users get value from or in the product. *“You can see if someone get really negative [honest] feedback [user experience] of your application when you are secretly [or passively] watching [or observing] them.”* On an ethical note, which the company take seriously, a respondent stated, *“We like our privacy as individuals. We kind of hate it if there is too much of information gathered from the end-users”*. Additionally, a respondent buttresses their stance on ethical knowledge and consideration on customer data; stating, *“I am not talking about installing cameras or microphones; but them [users] not consciously aware. Then you see what the user is struggling with. Many times, that surprises you a lot”*.

4.3.3 Customer Value (CV) Co-Creation Perspectives

An interesting take on customer value or holistic co-creation from the data analysis was cutting-edge high-level approach and understanding of customer value co-creation seen at the case company. *“And the companies or organizations that co-create will benefit [anytime even in the future]. Maybe there will be some version later on that will not be for free.”* The above statement with companies co-creating, is a new learning not provided in traditional requirements engineering textbooks. This understanding is well buttressed in fields such as marketing sciences where each participant is termed *an actor*. While knowledge, understanding and implementation of co-creation was significant at case startup; per their idiosyncratic practice, it was very much of the business-to-business (B2B) or customer-to-customer (C2C) perspective which then trickled down to the end-users as indirect partakers. While Prior & Marcos-Cuevas (2016) gave a simplified, an all-inclusive definition entailing interacting actors – be they providers or customer – each contribute to realize complementary benefits (*value*) in a collaborative process. Targeting co-creation also to customers (end-users) was a key concentration area in the systemic literature review of this thesis research in chapter three. Notably and to case company’s credit, this is an advancement. Notwithstanding, it is high time customers (users) became an equal focus of much of co-creative processes; more so, in virtually every application they use that are developed by startups.

Some other findings on co-creation practices include product enhancement, competitive edge, and a rather reflexive view of the customer. *“So, we are actually enhancing our product, which is again making the product more interesting [attractive] to those [corporate customers] who are interested in actually contributing or have their own modules added to it.”* Furthermore, while co-creation may not at first appear attractive or confer an edge as sources explained it is done without much fiscal returns as main motivation. However, an interviewee saw ways of adding value and gaining an edge through co-creation, *“ And they can see in couple of different ways of genuinely adding value to the whole software and community, which is a competitive advantage and the software is open to use. And that customer is actually adding to that which confers on us competitive advantage that we are doing this kind of software that is available for all.”* Lastly, possibly along the path of B2B high-level view, co-creation does create room for small to large firms to create co-creation platform, or reap network effect gain as buttressed by this excerpt, *“Then the other one is that some consumers [customers] do want; more of the direct side business customers — they also want visibility in the software which also gives again small complement. So, we are in a way providing a platform – more like a co-creation platform.”*

4.3.4 Customer Value (CV) Challenges

Key findings on challenges focusing on customer value challenges are: feedback data's complexity in using it for product improvement, or the wherewithal (possibly *time*) to use the obtained analytics. *"How to actually use this data to enhance our product? That is always another question because we do not have the time to actually do the changes to the products unless we have some projects or something that we can actually use, or now when we are doing the co-creation model for [HomeFinder (not actual name — name anonymized)] for example; then different modules are actually paid for with our collaborators"*, explained a respondent.

Another challenge identified was focusing on doing too good job, which can be expensive. A respondent decried the lengthened time required. *"And that usually takes too much time...."* This may cause budget overruns, or unnecessarily delays in project delivery date, or worse yet, cause scope creep—requirements omission, with(out) technical debt (Firesmith 2007). While intellectual resource demand may not have been a huge challenge in researched company, the stress is noted or identified by practitioners. This is so as case company has an array of well-educated and multi-disciplinary team with almost all board members; who double as employees, having at least a Master's degree. Their advantage could have easily been a concern as demonstrated in an excerpt, *"Many of the things are thought oriented: you have to actually think things through, almost all the time."*

4.4 Other Interesting Findings

Some good-to-know results which were not intentional sought did occur. Such side findings are presented in sections 4.4.1 & 4.4.2 subsequently.

4.4.1 Interesting Take on Customer Engagement (CE)

As the thesis research progressed and with selective analysis – making sense of the analyzed data ; which supplied rich information on customer engagement awareness, knowledge, and novelty amongst practitioners, some interesting notes emerged. Summarily stating the key interesting take in customer engagement learning include:

- Awareness of CE's importance in case company is substantive
- CE Practices e.g. engagement environments are uncommon possibly owing to scarce resources
- Need to learn about customer product behavioral pattern to improve software is important
- Customers' business value is vital and improvable by e.g. having Customers or users CE channel
- Usage analytics from application may be challenging to integrate in product improvement
- Customer participation/involvement is practiced to varying degrees swayed by customer interest
- User interaction with provider (developer firm) may not be a central theme for consideration
- There is yet significant lack of user-centered CE practices when a firm is beginning
- There is apparent need of CE cycle & process knowledge to further harness CE benefits
- Possible challenges inherent in CE channel may not be envisioned

4.4.2 Role of Elicitation Techniques in RE Practices Adoption

In requirements engineering practices, elicitation is observed to play a tangible role in keenness to adopt, or success of adopting some requirements engineering practices e.g. iterative development which proves pivotal in bulk of case company's projects. The observed elicitation techniques used, which attracts its own consideration from primary studies, show that the elicitation techniques were limited to:

- group elicitation techniques: team dynamics exploitation, workshops, meetings, brainstorming;

- prototyping – used when a customer has vague to-be-developed product specification knowledge
- traditional techniques e.g. interviews (unstructured or informal) and document analysis

4.5 Further Advancement – Strengths & Good-to-Have

Empirical evidence reflection indicates significant potential for advancement from current practices and a few improvements or additions. Table 25 below explicate the strengths and good-to-have areas observed and proposed respectively for further advancement.

Table 25. Findings on Management Strength & Key Areas Needing Attention.

Focus	Observation(s)	Focus Remark
Strengths	<ul style="list-style-type: none"> • Educated Board — Multidisciplinary team • Experimentation with size benefit • Reduced lead time attractiveness • Potential for training & constant learning success 	Areas where great potential lies for further advancement centering on personnel and size
Good to Have	<ul style="list-style-type: none"> • Iterative development need • Strive to reduce or eliminate Technical debt • Technical knowledge in customer deliberations • Inculcate Feedback to enhance product • Software training for management staff 	Agile practices in requirements gathering and elicitation approach is needed to improve customer satisfaction

4.5.1 Strengths

Strength explains qualities, characteristics or practices that are of an advantage and currently in place at case company that will aid or speedup further advancement. The multidisciplinary educated team is a resource bank to count on for further advancement. As a start-up, the ease to experiment given the relative size of project and fiscal investment allows for more room to experiment. While this is an advantage now which should be used to establish more concrete ways of getting the task done, it may not be so in the long-run when the firm begins to grow. Along same lines, reduced lead time enjoyed for swift ways of working which may not be so sustainable for all could be finetuned to be easily reproduceable, and as an organisational culture than being individuals' approach or zealously. Given an array of experts in various fields, training can easily be done. Also, learning for staff will very likely yield its dividends and is highly encouraged.

4.5.2 Good-to-Have

The most notable good-to-have from empirical evidence will be an iterative development & process of requirements gathering as bulk of customer projects may require them. Also, iterative requirements gathering increases the likelihood of customer satisfaction. However, it is noted it may come with its implications such as customer unavailability. This should be adequately catered to before project kick-off e.g. in negotiation meetings stating the need for client personnel availability e.g. dedicated product owner (PO). Besides, ensuring the above practices will help minimize waste and the need for technical debt or scope-creep (requirements omission). Borrowing technical knowledge for customer deliberations can be done in-house by having formal meetings with technical staff where the high-level requirements are spelt out in more details. Otherwise, their advice could be used with flexibility at client meeting. Besides, there will be need to find ways to use learning from usage analytics in product improvement. This need will be to reap any competitive edge that such learning may confer amidst changing customer taste, and to earn loyalty. Importantly, remedial courses for staff members with little to no software engineering

background could aid navigating some everyday software engineering challenges vis-à-vis requirements engineering issues.

5. Discussion

This chapter has 5 sections. The first three sections address, discuss and answer the research questions RQ1-RQ3. The other sections, sections 5.4 & 5.5 refer to research limitations & implications; and implications for practice respectively. Section 5.1 presents the empirical research in answering RQ1. Section 5.2 summarily discusses the systemic literature review as it tends towards better practice understanding, and section 5.3 considers areas needing attention as recommendations to further improving current CE & RE practices.

5.1 RQ1 Customer Engagement (CE) & Requirements Engineering (RE) Practices

Customer engagement practices are helped by some concept that resulted from empirical study. These include customer engagement value, customer engagement environment and collaborative practices. Also, the section discusses CE practices based on the foundations got in answering research question RQ1:

RQ1: *What customer engagement and requirements engineering (RE) practices are in place at the case company?*

5.1.1 Customer Engagement – Foundations and Practices

Customer engagement value (CEV) entails benefits a developer firm derives from clients or customers holistic participation in the firm' offering. CEE is a motivation for most CE practices adoption though the pain of assessing this novel aspect of a customer for software startup was noted. Besides, CEV does offer more to customers as well. For instance, a customer's holistic evaluation may go beyond that of their fiscal project value; and give them an endogenous view (Jaakkola & Alexander 2014). This approach makes customers have a say in their offering provided by the firm.

Customer engagement environment. Avails the firm an avenue to co-create with customers and help customers, including end-users, to interact and navigate the CE cycle with the aim of increasing connections and customer satisfaction. While different media may be used e.g. texting, word-of-mouth, instant messaging, emails or blogging, by customers for interaction with clients as claimed by Sashi (2012), having a corporate social network (CSN) may help the firm respond to such consequences of interactions.

Customer engagement collaborative practices e.g. customer participation, involvement or collaboration was identified. Case company, given its current state of CE practices, limited this to projects where customers [should] actively interact to increase likelihood of project success. Two customer types were identified — active and passive customers. Active customers are actively concerned and willing to participate in almost all of a project's activities. But passive customers are least interested about being involved, and would rather delegate their responsibility to developer firm. This latter customer type does have lesser chance of having successful projects.

Customer engagement practices at case company were customer segmentation to better serve client; constantly learning from users to improve quality and satisfaction – a prerequisite for customer retention; and prompt feedback redress to mitigate any customer value co-destruction. Though case company does not currently have a dedicated customer environment; it does however have a co-creation platform dedicated to a customer segment in the housing industry where they actively involve customers in co-creation at a B2B or C2C level. These four (4) practices are well established CE practices at case company.

The level of practice adoption is hampered by resource limitation. This manifested in wherewithal, or limited human resource allocation. Noted, added knowledge of foundational principles of CE and their potential gains for startup is needed as well e.g. customer engagement behavior to reap co-creation gains.

5.1.2 Requirements Engineering – Foundations and Practices

Requirements engineering (RE) practices in case company were influenced tangibly by **elicitation techniques**, and **requirements gathering** process. These factors were further compounded by **customer needs complexity**. There were more RE practices, seven (7) in total relative to CE practices possibly owing to RE being more mainstream, and as almost old as software engineering.

Elicitation techniques used at case company were those in group elicitation techniques, traditional techniques and prototyping. Group elicitation techniques included brainstorming, meetings and team dynamics exploitation. Examples of tradition techniques were interviews, document analysis, and to some extend surveys. Prototyping was done using already developed product or other references.

Requirements Gathering. This is often done with detailed (heavy) documentation which suffices for traditional process where all requirements can be possibly stated before project commencement. But the reality is, not many customers present projects that can be developed with traditional process of software engineering. So, any attempt to use a silver bullet for projects specifically requiring one and only one of iterative or traditional process will meet a dead-end. Such approach leads to change retardation – reduces customer satisfaction and usability of the developed software. While heavy documentation suffices for tradition process projects, it does mitigate the gains of face-to-face communication, is resourcefully expensive, and it least welcomes change. Gaining added knowledge of RE process as advocated by Husain, Mkpojiogu & Kamal (2016) will be invaluable.

Customer Needs Complexity. Customer needs are always changing. This occur even as project progresses, and make firm incur addition cost. The challenge here may be in the allocated resources – human capital, time and required work knowledge estimation. First this key finding buttresses Hofmann & Lehner's (2001) claim that customers do not know what they want. This further amplifies the need to involve customer at every stage where being developed product may serves as 'prototype'.

Requirements engineering practices at case company includes prototyping, face-to-face-communication, customer involvement, continuous planning, and detailed documentation. Requirements change management is yet emergent. Requirement management is still *ad hoc*. Need for more established approach e.g. use of requirements management database (Niazi *et al.* 2012) is considered important by case company as it moves in that direction.

5.2 RQ2 Good CE & RE Practices Able to Improve CV Co-Creation

In this subsection some customer engagement and requirements engineering practices able to improve customer value co-creation is presented. This section tries to answer the research question 2:

RQ2: Which customer engagement (CE) and requirements engineering (RE) practices can improve customer value (CV) co-creation?

It also discusses customer value creation per those who actively engage in the creation process – users and customer.

5.2.1 Good CE Practice Supporting CV Co-creation

Customer engagement is not interchangeable with customer collaboration, involvement or collaboration. Brodie *et al.* (2011) decry the ambiguity that characterize these relational concepts. This is more interesting as these relational terms are enshrined in the Agile Manifesto – a rich source of most agile practices that are commonplace in software firms. So, the need to make obvious this dichotomy could not be timelier. Bowden (2009) posit that collaboration, involvement or participation are antecedents (forebears) of CE. A key concept to be considered before CE practices is CE cycle for its pivotal role in understanding the CE process.

CE Cycle. Customer engagement (CE) cycle presents a graphical navigation map of a customer in their ascension from connection to engagement. It is through these stages of CE cycle that most CE practices such as user-to-user interaction is used. The explanations of the stages are mostly drawn from Sashi (2012). **Connection** is the foundation (first step) for a customer to establish any emotional bond with provider or developer firm. Provider as well as customers can accentuate this connection directly by bringing more customers [*or repeat purchases*]. **Interaction.** Goes beyond communication with provider to include amongst customers or even potential customers and customers. This could be harnessed to achieve improve customer satisfaction. **Satisfaction.** When customers are satisfied, they are more likely to interact. Sashi claims satisfaction is two-dimensional : cumulative, and transaction-specific customer satisfaction. He posits that the former accrues overtime. **Retention.** Continued relationship between client and provider manifest in repurchases or emotional loyalty with each able to exist on its own. Sashi contends customer satisfaction positively influences retention, and not affective commitment (emotional bond). **Commitment.** Manifests in affective commitment or calculative commitment – loyalty from unavailable substitute, convenience, or to-be-incurred cost of switching. Calculative commitment is a higher ranker for customer loyalty (Sashi 2012). **Advocacy.** Occurs when customers actively – voluntarily or motivated – engage in making new *connections* for provider product or brand. **Engagement.** When advocacy is in place and affective, as well as calculative, commitment, and trust; a customer reaches this point — is engaged. At this stage customer engagement is said to occur with the customer.

CE Practices such as having a devoted users' channel, motivate user-to-user interaction, incentivized user-participation in advocacy and broadened view of customer to include pre-transactional and post-transactional ones will help advance customer value co-creation besides those already in use. However, benefits of these practices cannot be fully harnessed if the above consideration is not understood as important.

5.2.2 Good RE Practices Supporting CV Co-creation

This section discusses requirements engineering (RE) process; mainly requirements definition as it aids elicitation techniques and their selection. Then, it discourses RE practices in adding to customer value co-creation.

RE Process. Lehner & Hofman (2001) identified the importance of RE process consisting of elicitation [, analysis], representation, verification and validation; for project success. More importantly the need to revisit this at every stage of the project or product development is advocated. Mkpojiogu & Kamal (2016) contend that requirements management ensures that traceability exist and dynamic change management is in place, with the latter being a concern in agile projects. The concern is mostly that some of these items (developed features) are not always reflected in the requirements definition, particularly in the representation. This usually courses traceability issues for the requirements engineers and system

evolution much later. Therefore, Niazi et al. (2012) advocate using a requirements management database (RMDB) which they consider a must-have for every project irrespective of its size.

RE practices. Inayat et al. (2014) and Cao & Ramesh (2008) identified seventeen (17) and seven (7) RE practices though the former is a superset of the latter. Komssi *et al.* (2010) added two more practices not covered in the earlier set – specification template and collaborative workshop. RE practices that can improve customer value co-creation besides those currently practiced in case company include: iterative requirements gathering with over 85% industry practice (Cao & Ramesh 2008); requirements prioritization though extreme in agile practices (Racheva *et al.* 2010; Inayat *et al.* 2010); requirements change management – makes change or rework less costly; reviews and acceptance testing – should be done weeks before production or delivery date (Komssi *et al.* 2010); use of specification template which serves as basis for documentation though not so pro-agile. Other practices worth adding include requirements representation and management (Inayat et al.). Possible use of user stories (Bjarnason *et al.* 2015) and better prototyping to reduce error margins and eliciting requirements that are user generated (Kapyaho & Kauppinen 2015) are worthy additions.

5.2.3 Customer Value (CV) Co-creation

Value. Barney et al. (2008) relates that economic theory presents value as customer loyalty earned from satisfaction or delight, possibly with consequent repurchase behavior. This definition details what customer value entails for both customer and provider. Besides, it adds CE gains as added basis for value.

Co-creation. Ramaswamy & Ozcan (2018) posit that co-creation is enactment of interactional construct through system-environments powered by interactive channels, which produce defined or changing roles for each experiential participant. Prior & Marcos-Cuevas (2016) reiterate that the co-creative processes do not necessarily imply service or product exchange but an exchange of activities including experiential exchanges. Importantly, for firm-to-customer, or to user (B2C) co-creation, the obvious absence of service or product exchange at any level is not an impediment. This is very important from empirical evidence to also embark on user-centred co-creation for customer value delivery to both firm and customer (*or user*).

5.3 RQ3 Recommendations on Improving Current CE & RE practices

This section proffers recommendations on achieving better customer engagement and requirements engineering practices. Basically, it aims to further improve, and reap more benefits from current CE and RE practices. The focus is to answer RQ3:

RQ3: *What recommendations can help the case company improve current CE and RE practices?*

5.3.1 CE Recommendations to Enhance CE Practice Gains in Case Company

To further improve current CE and Re practices, some contributions, or enhancers may be needed. These include considering building an effectual CE environment, learning about customer engagement behavior, and understanding customer engagement value. Each of these aspects will improve current practices, and accentuate the gains that accrue from CE practices and help in additional practice adoption.

Effectual customer engagement environment (CEE). Depending on the needs or goal of a developer firm, a CE environment may be developed. Zhang et al. (2017) assert that corporate social networks (CSNs), or fan pages, reap benefits for companies through interaction with or amongst customers or potential customers. Nazakat & Hong (2017) argue for the requirement engineering (RE) benefits of CSNs or CVEs. They claim that social network services have supported software firms in coping with varying limitation found in RE traditional approaches at various stages including elicitation, prioritization, and negotiation.

They further add that this is timelier an avenue in catching up with the ever-changing needs of those for whom the software system is being developed – customers or users. Importantly though, much as benefits accrue in building an effectual engagement environment for users or customers, it however, takes more – resource allocation. Effective monitoring or addressing concern in provider engagement environment should be a priority to mitigate any co-destructive challenges. Also, engagement environment should not replace face-to-face communication which is often a tendency. Importantly, resource allocation to CEE is a huge determinant of success — not monitoring such provided environment may lead to customer value co-destruction (Jaakkola & Alexander 2014). This potential pitfall may not be conspicuous, which further explains the novelty of CE in software engineering even amongst practitioners in software startups.

Customer Engagement Behavior (CEB). The goal here is to observe, per the developed application, user behavioral manifestations. Along these lines, Biljmolt et al. (2010) defined CE as a behavioral manifestation of customers towards a firm's brand beyond purchase or product acceptance. This is often the hallmark or benchmark behind data gathering used in product enhancement or improving customer satisfaction. To maximize the benefit of CEB, any tool or platform used for engagement would do. Cheung *et al.* (2015) argue that a long-term competitive edge is inalienable from a firm's ability to retain and expand its *connections* through developing strong engagement with their customers. Jaakkola & Alexander (2014) see CE as an aggregation of ways customer behavior; extra-transactional and transactional, impact the firm. Extra-transactional includes connections and before interaction are made (pre-transactional) and after project completion or product release — satisfaction or not (post-transactional). Post transactional exchange could exist between retention and engagement in the CE cycle.

Customer Engagement Value. Entails assessing the contributions of the client to the firm's progress beyond their purchase sum; known as customer lifetime value (CLV). This includes their influence potential — customer influence value (CIV); their referral potential — customer referral value (CRV); and their innovative knowledge contribution — customer knowledge value (CKV), upholds Kumar et al (2000) and Jaakkola & Alexander (2014). The scholars argue the summative value could better represent the [engagement] value of a customer in CE practices.

Practices such as having a devoted users' channel, room for user-to-user interaction, incentivized user-participation in advocacy and broadened view of customer to include pre-transactional and post-transactional ones will help advance customer value co-creation besides those already in use. However, benefits of these practices cannot be fully harnessed if the above considerations are not addressed as important.

5.3.2 RE Recommendations for Improving Current Practice in Case Company

There is need to consider expanding the scope of elicitation techniques and even more importantly learn more about their suitability in enhancing the selection process. This is so, as expanding the scope alone will not necessarily suffice —it could add marginal gains. Particularly, expanding and learning will provide further gain should case company move towards agile RE practices.

Elicitation Techniques. Technique specifies how a given activity is to be performed, possibly including its notation (Hickey & Davis 2002). Elicitation is a process of getting customer (or stakeholders') needs from customers or stakeholders. These techniques could be traditional techniques e.g. use of surveys, or questionnaires (Dicicco-Bloom & Crabtree 2006); prototyping (Kapyaho & Kauppinen 2015); group

elicitation techniques e.g. focus group or brainstorming; or model driven e.g. goal-based Keep All Objects Satisfied [KAOS] (van Lamsweerde *et al.* 1998). Besides, cognitive techniques such as think aloud (protocol analysis), and use of probes; contextual techniques, though time consuming e.g. ethnography and conversation analysis (Nazakat & Hong (2019) could be most resourceful in its findings.

Technique Selection. Customer needs complexity as identified in the empirical study and secondary study makes this a critical consideration. Kauppinen & Co. (2007) assert that needs can be articulated or unarticulated. Hence a need to select an appropriate elicitation technique. An aggregation of the innovation potential locking in hidden needs and the quest to minimize the unserved customer segment, are key motivations prompting acquaintance with key, possibly small set of, elicitation techniques, understanding them, and deciding which is/are the most appropriate in any given instance. However, the most effective for a case is not always the most complex — could simply be asking a question. Having trained requirements engineers or training those who are in such position, *and not practice [alone]*, will significantly enhance selection prowess (Hickey & Davis 2002).

There is considerable elicitation, analysis, and validation by firm at high level specification meetings. However, representation, or modelling is not visible. Despite the practice by some software firms to not represent or model their requirements, it is not a good practice and is highly discouraged. This practice— not modeling, is not recommended by Hofmann & Lehner (2001) who see the four components — elicitation, [analysis,] modeling, verification & validation; as pivotal for project success. Again, dense documentation may make keeping up with the representation a further challenge. Hence, reduced heavy documentation is good for iterative requirements gathering. Based on empirical evidence an advancement will be to have iterative requirement gathering as one of major practices (Cao & Ramesh 2008).

5.4 Research Limitations/Implication

One consideration per limitation is the part consideration of those participants (actors) concerned by the research — customers and provider firm; only two (2) MR Inc.'s informants were involved in this research's interviews. A second limitation to this study is internal knowledge which the researcher has; given it could lead to assumptions. To counter the former limitation, the research employed the services of the thesis instructor, a research fellow with years of experience who scrutinized all questions and was most helpful — ensured any bias was at its barest minimum. On the second limitation, the research was not actively working in the case company just before commencement of this thesis research while liaising with case company. Thirdly, though the researcher had prepared to involve customers with customer complete questions set, due to prevailing conditions, it was not feasible to have them in the research. Internal knowledge, however, did help the research and researcher in experiences, informal conversations, and participant observation while researcher was actively involved with the case company. This helped create triangulation and richness in the gathered data and its analysis. Importantly, researching more startups and across multiple subsectors in IT industry would have been more potent. But given the nature of this research (MSc thesis) and its duration, the scope was beyond it. Also, hearing from the customers would be a potential gain of knowledge.

Another consideration for validity was quality of the systemic literature review. To minimize validity threat to secondary studies, the reviewed literatures were almost all from journals or conference papers — 97% (71 of 73). The non-articles (*not* journal or conference papers) were contents e.g. chapter of a book. Besides the significance, or relatedness and usefulness of the article to the research question, the citation

count and general quality of each article including its number of authors, research duration, year of publication, and empirical evidence findings as all detailed in Table 4 on page 8 were passing yardsticks for consideration. This ensured quality in the secondary study.

5.5 Practical Implications

The motivation for this research is in the novel state of customer engagement in software engineering practices. The implication for practices is first to set a basic knowledge of customer engagement for a small software company in understanding and motivating adoption of customer and user-centered customer engagement practices. Together with requirements engineering, the further goal was to strengthen RE practices in software startups. Importantly, to understand the current state of practices, and mitigating factors in software startups per CE and RE practices. This research has made known the desire of CE practices in a small software firm. Also, it has posited some challenges that small software firms may have regarding adopting CE and RE practices.

Importantly, key findings suggest key research institutes such as universities could offer software knowledge to corporate entities to meet particular goals. This does not necessarily have to be entire degree programs; could be, but suited to executives who may need refresher courses. Notably, it should be flexible and motivating with practice perspective to be motivating enough. This will be most helpful for a small software company where an executive may want to have more formal knowledge of software or requirements engineering.

6. Conclusions

Per research problem; customer engagement strengthens RE practices through active interaction between provide–customer, customer–user; and amongst provider–customer–end-users to positively influence CV co-creation. To achieve this feat CE must be funneling resources to RE practices. Also, CE gains insights through RE practices with both essentially addressing CV co-creation concerns. Hence, CE tries to ensure a connection, ideally establish a relationship, with the client and accentuate customer satisfaction to delight. Good RE practices ensure that potential value is delivered by the provider almost guaranteeing customer satisfaction, and quality in product so developed. It is important to state neither is an island in itself. CE and RE practices need each other.

There are four (4) customer engagement (CE) practices, and seven (7) requirements engineering (RE) practices established at the case company. CE practices include customer segmentation, in-project or high level (B2B or C2C) co-creation platform, continuous learning from users (*customers currently*), and prompt feedback redress. RE practices such as prototyping, face-to-face communication, detailed documentation, customer involvement, continuous planning, and requirements management are evident in the case company. CE practices not yet in place such as the use of incentives, broadened customer view, user-to-user interaction and devoted user channel are important to consider.

Understanding CE significantly, and some of its practices couple with RE practices that yield high-perceived value may significantly help improve customer value (CV) co-creation. Getting abreast with CE includes assimilation of customer engagement behavior (CEB), customer engagement value (CEV), and CE cycle. Importantly, this knowledge will help in profound understanding and implementation of CE practices such as building effectual dedicate customer engagement environment, motivating user participation, broadened customer view, and CE value assessment. Additionally, iterative requirement gathering, requirements change management, frequent customer participation in projects, doing reviews and acceptance testing at least a week before production or delivery date, and possible use of user stories, are RE practices that can drastically improve CV co-creation.

Practices like detailed documentation, use of prototype, change and requirements management, and co-creation platform participation can be improved upon. Detailed documentation, while it has its advantages, may not fulfill average business concerns of most customers with changing needs. Hence, it could be reduced. A further motivation is that it may impede the need for face-to-face communication or frequent customer participation as customers feel, ‘I told them everything — it is documented.’ Use of prototype is significantly advocated. However, approach may be reviewed — *when it may not help the customer come-up with their own idea of what they want*. The product so developed may end up being just a modified generic product as against bespoke software. Use of requirements management database (RMDB) could help both change management and requirements management. Evolving ways to learn from users (CEB) directly could aid feedback redress. Lastly, giving incentives to customers (or users) may increase interaction and participation across board.

Further research could be required in same topic to address research limitation 1 which was the internal view. Besides, research is sought to address limitation concern 3 on customer perspective. Also, further research is required in customer engagement and its practices not only in a small firm, but in software companies in general. Such research could focus on customer environments, and how they help customer value creation e.g. ‘Effect of Customer Co-creation Platform on Customer Value.’ Lastly, a broader view outside extended reality (XR) in CE and RE practices is welcomed to address another research limitation. In general, more insight on the impact of customer engagement and its practices on software firm performance may yet be glossy. It is about time more research is done to unveil challenges and benefits for improved organisational performance and growth — major motivations of this research.

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Appendices

APPENDIX A — Company Interview Questions

Darlington's Thesis Interview Questions

Purpose: To study customer and company (provider) interaction and its impact in small software companies. The study is carried out as a master's thesis research at Aalto University School of Science and Technology to help small software companies assess their advantages and challenges in customer-provider collaboration channeled towards creating a competitive edge.

Confidentiality

Thank you for agreeing to be interviewed as part of the above research project. Ethical procedures for academic research undertaken from Aalto University Finland requires that interviewees explicitly agree to being interviewed and know how the information contained in their interview will be used. This consent is necessary for us to ensure that you understand the purpose of your involvement and that you agree to the conditions of your participation. Would you therefore read the accompanying information and orally certify that you approve the following:

- the interview will be recorded and a transcript will be produced
- you will be sent the transcript and given the opportunity to correct any factual errors
- the transcript of the interview will be analyzed by Darlington Omoifo as research investigator
- access to the interview transcript will be limited to Darlington Omoifo
- I also understand that my words may be quoted directly
- any summary interview content, or direct quotations from the interview, that are made available through academic publication or other academic outlets will be anonymized so that you cannot be identified, and care will be taken to ensure that other information in the interview that could identify yourself is not revealed
- the actual recording will be destroyed after research publication – thesis approval
- if I wish the transcripts generated will, after research publication, be destroyed

Thesis Topic: Improving Customer Value Co-creation through Customer Engagement and Good Requirements Engineering Practices in Small Software Firms

Customer Engagement (CE) or Collaboration Questions

Brief explanation: **Customer Engagement** (CE) can be described as customer collaboration or involving ways and approaches to know or keep abreast with a firm, their offering – product or project.

1. Could you briefly describe your role in this company and tell how long you have worked here?
2. How would you on a high level describe customer collaboration here at your company?
3. Could you describe how you have involved customers in your past projects?
4. Does your company have a channel or avenue for interaction with potential customers or customers?
5. Do you discuss business value of a customer in your company?

6. What does your company do to learn about how the user or customer uses any of the products you developed?
7. What are, if any, some customer collaboration results in projects for your company that have been:
 - a) Challenging to handle?
 - b) Beneficial to your company?

Good Requirements (Features) Engineering Practices Questions

Brief explanation: **Requirements engineering (RE)** is the mechanism in place to identify, get and manage the needs of the customers or stakeholders in product or project delivery. It serves the development phase of project or product development. **Requirements** simply put may include features or regulatory obligations a system needs to have to work (function) or be approved for use.

1. What practices do you currently have for gathering and managing features in your company?
2. Do you have trained staff responsible for RE practices?
3. What stages does what a customer says they want go through to qualify as a requirement?
4. How does your company manage features (*requirements*) changes?
5. What is your company's most used practice (technique or way) of getting features from customers or users?
6. How do you choose your techniques for gathering features (requirements)?
7. Use of requirements engineering practices challenges and benefits:
 - a. Are there any challenges?
 - b. Are there any benefits?
8. How important would you say requirements engineering is for project success?

Customer Value Co-Creation Questions

1. What does customer value mean to your company?
2. Who are your considered beneficiaries when you think of customer value delivery?
3. Do you gather information about the end-users?
4. What are, some challenges encountered during projects, if any, in customer value delivery?

Co-creation is a function of interaction (Grönroos & Voima 2014). The interaction participants or actors e.g. customer or provider, each contribute to realize complementary benefits in a collaborative process (Prior & Marcos-Cuevas 2016).

5. How would you use co-creation to enhance value for your company and client?

APPENDIX B — Customer Interview Questions

Darlington's Thesis Interview Questions –

client

Purpose: To study customer and company (provider) interaction; using company's good practices, and its impact in small software companies. The study is carried out as a master's thesis research at Aalto University School of Science and Technology to help small software companies assess their advantages and challenges in customer-provider collaboration channeled towards creating a competitive edge.

Confidentiality

Thank you for agreeing to be interviewed as part of the above research project. Ethical procedures for academic research undertaken from Aalto University Finland requires that interviewees explicitly agree to being interviewed and know how the information contained in their interview will be used. This consent is necessary for us to ensure that you understand the purpose of your involvement and that you agree to the conditions of your participation. Would you therefore read the accompanying information and orally certify that you approve the following:

- the interview will be recorded and a transcript will be produced
- you will be sent the transcript and given the opportunity to correct any factual errors
- the transcript of the interview will be analyzed by Darlington Omoifo as research investigator
- access to the interview transcript will be limited to Darlington Omoifo
- I also understand that my words may be quoted directly
- any summary interview content, or direct quotations from the interview, that are made available through academic publication or other academic outlets will be anonymized so that you cannot be identified, and care will be taken to ensure that other information in the interview that could identify yourself is not revealed
- the actual recording will be destroyed after research publication – thesis approval
- if I wish the transcripts generated will, after research publication, be destroyed

Thesis Topic: Improving Customer Value Co-creation through Customer Engagement and Good Requirements Engineering Practices in Small Software Firms

Customer Engagement (CE) or Customer Collaboration Questions

Brief explanation: **Customer Engagement** (CE) can be described as customer collaboration or involving ways and approaches to know or keep abreast with a firm, their offering – product or project. It ensures customers are satisfied at all times even after purchase or delivery of a software system. **Provider** – software company that develops a project, product or solution suite for a you or your company.

8. Introduction question on respondent:
 - a. Could you briefly describe what you do; as an employee of this customer company to the provider?
 - b. How long have you worked here?
 - c. How long has your company had dealings with the provider company?
9. As a customer, could you describe how your collaboration with provider has been carried?

10. What has been your role as a customer in project(s) that this provider has developed for your company?
11. Does your company have any dedicated channel or avenue for collaboration with provider?
12. What kind of challenges have you had in interacting with the provider?
13. What kind of benefits have you had in interacting with the provider?
14. At what point do you assess the value of a developed software system?

Good Requirements (Features) Engineering Practices Questions

Brief explanation: **Requirements engineering** is the mechanism in place to identify and manage the needs of the customers or stakeholders in product or project delivery. It serves the development phase of project or product development. **Requirements** simply put may include features or regulatory obligations a software system needs. Feel free to use terms such as features or whatever your company uses.

9. How does your company manage a project's features to be developed by a software company (provider)?
10. How would you describe your company's role in the requirements definition of the features implemented in your company's projects?
11. How does a provider get features from your organization?
12. How would you describe the requirements gathering process with your provider?
13. Do you consider business value of your features (*requirements*)?
14. Benefits and challenges of feature management (*requirements engineering*) practices you have used:
 - a. What were the challenges related to features, if any, your organization encountered?
 - b. What were the benefits your organization derived from this activity?
15. How important would you say feature management (*requirements engineering*) is for project success?

Customer Value Co-Creation Questions

6. As a customer, what does value mean to you?
7. What does customer value mean to your company?
8. Do you gather information about the end-users? (if yes, how?)
9. What challenges, if any, have you had during projects relating to customer value delivery?

Co-creation is a function of interaction (Grönroos & Voima 2014). The interaction participants or actors e.g. customer or provider, each contribute to realize complementary benefits (*value*) in a collaborative process (Prior & Marcos-Cuevas 2016).

10. How would you use co-creation to enhance value for your company, and possibly provider?

APPENDIX C — Respondent Consent Form

Interview Consent Form

Research Purpose: To study customer and company (provider) interaction; using company's good practices, and its impact in small software companies. The study is carried out as a master's thesis research at Aalto University School of Science and Technology to help small software companies assess their advantages and challenges in customer-provider collaboration channeled towards creating a competitive edge.

Research Thesis title: Improving Customer Value Co-creation through Customer Engagement and Good Requirements Engineering Practices in Small Software Firms

Researcher's Name: Darlington Omoifo

The interview will take one to one and a half (1 to 1,5) hours. We don't anticipate that there are any risks associated with your participation, but you have the right to stop or ask for timeout during the interview.

Thank you for agreeing to be interviewed as part of the above research project. Ethical procedures for academic research undertaken from Aalto University Finland requires that interviewees explicitly agree to being interviewed and how the information contained in their interview will be used. This consent form is necessary for us to ensure that you understand the purpose of your involvement and that you agree to the conditions of your participation. Would you therefore read the accompanying information sheet and then sign this form to certify that you approve the following:

- the interview will be recorded for research purposes and a transcript will be produced
- the transcript of the interview will be analyzed by researcher – Darlington Omoifo
- the actual recording will be destroyed after research publication – thesis approval
- the thesis will be available to you prior to publication to ensure no confidential information is contained

All or part of the content of your interview may be used:

- In academic papers or policy papers
- In an archive of the thesis as noted above

Participant's Signature & Date

Researcher's Signature & Date

Participant's Name

Appendix D — Code (Group Code) Tree — Categorization

ATLAS.ti Report

New Improving CV Co-Creation through Customer Engagement & Good RE Practices

Code groups

Report created by Omoifo Darlington on 17 May 2020

◇ business value of customer

Members:

- assessing customer business value challenge
- business value calculation
- startup culture advantage: faked by larger firms

◇ CE Observations Findings

Members:

- benefits:customer engagement
- customer engagement
- customer engagement benefit experience
- customer engagement channel
- customer engagement: a novel goal
- customer engagement: channel provider uniqueness
- customer engagement: must deliver value
- customer engagement: stages or phases
- customer engagement:advocacy
- customer engagement:collaboration
- customer engagement benefit better estimation
- customer participation: levels
- customer participation: passive or slight
- customer participation: total

◇ co-creation concepts, perspectives, and value

Members:

- benefits co-creation:provider
- benefits:co-creation
- co-creation
- co-creation: B2B actor perspectives
- co-creation: understanding concept
- co-creation:funding source
- co-creation:growth avenue

◇ collaboration challenges

Members:

- busy customers B2B
- customer expectations
- customer participation: levels
- customer participation: passive or slight
- elicitation technique use definition
- elicitation technique: specification tailored

◇ customer needs complexity, expectations and reality

Members:

- customer expectation: price dependent
- customer expectations
- customer needs customer mostly defined
- customer needs provider suggestion
- customer needs seeing and knowing
- experimentation
- unknown customer needs
- usability need customer centred design
- useful feedback

◇ CV unique - most valuable

Members:

- customer value
- RE: must deliver value
- stakeholders
- stakeholders:value chain

◇ elicitation challenge

Members:

- elicitation process
- elicitation technique use definition
- elicitation technique: specification tailored
- requirements gathering
- unknown customer needs

◇ expanding customer knowledge

Members:

- software is information business
- software process: iterative (agile) case
- software process: pure waterfall case
- telemetry

◇ high level hierarchical challenges

Members:

- resource limitation
- technical debt
- technical knowledge: business challenge
- technical knowledge challenge

◇ **hurdles to further advancement****Members:**

- experimentation
- feedback: challenge
- iterative development need
- mechanical telemetry challenge
- RE: change Management
- RE: good practices knowledge
- RE: process definition
- requirements gathering
- requirements: management
- software process challenge
- technical knowledge: multidisciplinary advantage
- telemetry challenge
- training personnel challenge

◇ **notable RE challenges****Members:**

- challenges: requirements engineering
- RE challenge: working culture difference
- RE: change Management
- RE: good practices knowledge
- RE: process definition
- requirements gathering
- requirements: management
- technical debt
- training personnel challenge

◇ **personnel & company background****Members:**

- company background
- respondents background

◇ **RE challenges, importance & benefits****Members:**

- benefits: requirements engineering
- RE benefits: customer understanding
- RE importance: emergent
- RE importance: most or one of the most
- simplicity

◇ **shocking customer realities for small SW firms****Members:**

- challenges: customer value
- credibility challenge
- customer value: definition challenge
- impediment to improving CV
- intellectual resource: consumption
- iterative development need
- training personnel challenge

◇ **source of CV learning & Improvement****Members:**

- feedback or data: motivation
- feedback: learning
- impediment to improving CV
- intellectual resource: consumption
- project estimation: time dependent
- roadmaps: planning ahead
- shared experience or knowledge challenge
- software process challenge

Appendix E — Atlas.ti's Code Tree

ATLAS.ti Report

New Improving CV Co-Creation through Customer Engagement & Good RE Practices

Codes

Report created by Omoifo Darlington on 17 May 2020

- **assessing customer business value challenge**

Created: 03/03/2020 by Omoifo Darlington, Modified: 05/03/2020 by Omoifo Darlington

Groups:

- ◇ business value of customer

- **benefits co-creation:provider**

Created: 05/03/2020 by Omoifo Darlington, Modified: 05/03/2020 by Omoifo Darlington

Groups:

- ◇ co-creation concepts, perspectives, and value

- **benefits:co-creation**

Created: 05/03/2020 by Omoifo Darlington, Modified: 05/03/2020 by Omoifo Darlington

Groups:

- ◇ co-creation concepts, perspectives, and value

- **benefits:customer engagement**

Created: 04/03/2020 by Omoifo Darlington, Modified: 05/03/2020 by Omoifo Darlington

Groups:

- ◇ CE Observations Findings

- **benefits:requirements engineering**

Created: 03/03/2020 by Omoifo Darlington, Modified: 05/03/2020 by Omoifo Darlington

Groups:

- ◇ RE challenges, importance & benefits

- **business value calculation**

Created: 03/03/2020 by Omoifo Darlington, Modified: 05/03/2020 by Omoifo Darlington

Groups:

- ◇ business value of customer

- **busy customers B2B**

Created: 03/03/2020 by Omoifo Darlington, Modified: 05/03/2020 by Omoifo Darlington

Groups:

- ◇ collaboration challenges

- **challenges: requirements engineering**

Created: 03/03/2020 by Omoifo Darlington, Modified: 05/03/2020 by Omoifo Darlington

Groups:

- ◇ notable RE challenges

- **challenges:customer value**

Created: 03/03/2020 by Omoifo Darlington, Modified: 05/03/2020 by Omoifo Darlington

Groups:

- ◇ shocking customer realities for small SW firms

- **co-creation**

Created: 03/03/2020 by Omoifo Darlington, Modified: 05/03/2020 by Omoifo Darlington

Groups:

- ◇ co-creation concepts, perspectives, and value

- **co-creation: B2B actor perspectives**

Created: 04/03/2020 by Omoifo Darlington, Modified: 05/03/2020 by Omoifo Darlington

Groups:

◇ co-creation concepts, perspectives, and value

- **co-creation: understanding concept**

Created: 05/03/2020 by Omoifo Darlington, Modified: 05/03/2020 by Omoifo Darlington

Groups:

◇ co-creation concepts, perspectives, and value

- **co-creation:funding source**

Created: 03/03/2020 by Omoifo Darlington, Modified: 05/03/2020 by Omoifo Darlington

Groups:

◇ co-creation concepts, perspectives, and value

- **co-creation:growth avenue**

Created: 05/03/2020 by Omoifo Darlington, Modified: 05/03/2020 by Omoifo Darlington

Groups:

◇ co-creation concepts, perspectives, and value

- **company background**

Created: 05/03/2020 by Omoifo Darlington, Modified: 05/03/2020 by Omoifo Darlington

Groups:

◇ personnel & company background

- **credibility challenge**

Created: 05/03/2020 by Omoifo Darlington, Modified: 05/03/2020 by Omoifo Darlington

Groups:

◇ shocking customer realities for small SW firms

- **customer engagement**

Created: 03/03/2020 by Omoifo Darlington, Modified: 05/03/2020 by Omoifo Darlington

Groups:

◇ CE Observations Findings

- **customer engagement benefit experience**

Created: 03/03/2020 by Omoifo Darlington, Modified: 05/03/2020 by Omoifo Darlington

Groups:

◇ CE Observations Findings

- **customer engagement channel**

Created: 03/03/2020 by Omoifo Darlington, Modified: 05/03/2020 by Omoifo Darlington

Groups:

◇ CE Observations Findings

- **customer engagement: a novel goal**

Created: 04/03/2020 by Omoifo Darlington, Modified: 05/03/2020 by Omoifo Darlington

Groups:

◇ CE Observations Findings

- **customer engagement: channel provider uniqueness**

Created: 04/03/2020 by Omoifo Darlington, Modified: 05/03/2020 by Omoifo Darlington

Groups:

◇ CE Observations Findings

- **customer engagement: must deliver value**

Created: 05/03/2020 by Omoifo Darlington, Modified: 05/03/2020 by Omoifo Darlington

Groups:

◇ CE Observations Findings

- **customer engagement: stages or phases**

Created: 04/03/2020 by Omoifo Darlington, Modified: 05/03/2020 by Omoifo Darlington

Groups:

◇ CE Observations Findings

- **customer engagement:advocacy**

Created: 04/03/2020 by Omoifo Darlington, Modified: 05/03/2020 by Omoifo Darlington

Groups:

◇ CE Observations Findings

- **customer engagement:collaboration**

Created: 04/03/2020 by Omoifo Darlington, Modified: 05/03/2020 by Omoifo Darlington

Groups:

◇ CE Observations Findings

- **customer engament benefit better estimation**

Created: 03/03/2020 by Omoifo Darlington, Modified: 05/03/2020 by Omoifo Darlington

Groups:

◇ CE Observations Findings

- **customer expectation: price dependent**

Created: 03/03/2020 by Omoifo Darlington, Modified: 05/03/2020 by Omoifo Darlington

Groups:

◇ customer needs complexity, expectations and reality

- **customer expectations**

Created: 03/03/2020 by Omoifo Darlington, Modified: 05/03/2020 by Omoifo Darlington

Groups:

◇ collaboration challenges ◇ customer needs complexity, expectations and reality

- **customer needs customer mostly defined**

Created: 03/03/2020 by Omoifo Darlington, Modified: 05/03/2020 by Omoifo Darlington

Groups:

◇ customer needs complexity, expectations and reality

- **customer needs provider suggestion**

Created: 03/03/2020 by Omoifo Darlington, Modified: 05/03/2020 by Omoifo Darlington

Groups:

◇ customer needs complexity, expectations and reality

- **customer needs seeing and knowing**

Created: 03/03/2020 by Omoifo Darlington, Modified: 05/03/2020 by Omoifo Darlington

Groups:

◇ customer needs complexity, expectations and reality

- **customer participation: levels**

Created: 03/03/2020 by Omoifo Darlington, Modified: 05/03/2020 by Omoifo Darlington

Groups:

◇ CE Observations Findings ◇ collaboration challenges

- **customer participation: passive or slight**

Created: 03/03/2020 by Omoifo Darlington, Modified: 05/03/2020 by Omoifo Darlington

Groups:

◇ CE Observations Findings ◇ collaboration challenges

- **customer partipation: total**

Created: 03/03/2020 by Omoifo Darlington, Modified: 05/03/2020 by Omoifo Darlington

Groups:

◇ CE Observations Findings

- **customer value**

Created: 03/03/2020 by Omoifo Darlington, Modified: 05/03/2020 by Omoifo Darlington

Groups:

- ◇ CV unique - most valuable

- customer value: co-creation

Created: 18/03/2020 by Omoifo Darlington, Modified: 18/03/2020 by Omoifo Darlington

- **customer value: definition challenge**

Created: 05/03/2020 by Omoifo Darlington, Modified: 05/03/2020 by Omoifo Darlington

Groups:

- ◇ shocking customer realities for small SW firms

- customer value: derivable value

Created: 18/03/2020 by Omoifo Darlington, Modified: 18/03/2020 by Omoifo Darlington

- **elicitation process**

Created: 03/03/2020 by Omoifo Darlington, Modified: 05/03/2020 by Omoifo Darlington

Groups:

- ◇ elicitation challenge

- **elicitation technique use definition**

Created: 03/03/2020 by Omoifo Darlington, Modified: 05/03/2020 by Omoifo Darlington

Groups:

- ◇ collaboration challenges ◇ elicitation challenge

- **elicitation technique: specification tailored**

Created: 03/03/2020 by Omoifo Darlington, Modified: 05/03/2020 by Omoifo Darlington

Groups:

- ◇ collaboration challenges ◇ elicitation challenge

- **experimentation**

Created: 05/03/2020 by Omoifo Darlington, Modified: 05/03/2020 by Omoifo Darlington

Groups:

- ◇ customer needs complexity, expectations and reality ◇ hurdles to further advancement

- **feedback or data: motivation**

Created: 05/03/2020 by Omoifo Darlington, Modified: 05/03/2020 by Omoifo Darlington

Groups:

- ◇ source of CV learning & Improvement

- **feedback: challenge**

Created: 05/03/2020 by Omoifo Darlington, Modified: 05/03/2020 by Omoifo Darlington

Groups:

- ◇ hurdles to further advancement

- **feedback: learning**

Created: 03/03/2020 by Omoifo Darlington, Modified: 05/03/2020 by Omoifo Darlington

Groups:

- ◇ source of CV learning & Improvement

- **impediment to improving CV**

Created: 04/03/2020 by Omoifo Darlington, Modified: 05/03/2020 by Omoifo Darlington

Groups:

- ◇ shocking customer realities for small SW firms ◇ source of CV learning & Improvement

- **intellectual resource: consumption**

Created: 05/03/2020 by Omoifo Darlington, Modified: 05/03/2020 by Omoifo Darlington

Groups:

- ◇ shocking customer realities for small SW firms ◇ source of CV learning & Improvement

- **iterative development need**

Created: 03/03/2020 by Omoifo Darlington, Modified: 05/03/2020 by Omoifo Darlington

Groups:

◇ hurdles to further advancement ◇ shocking customer realities for small SW firms

- **mechanical telemetry challenge**

Created: 03/03/2020 by Omoifo Darlington, Modified: 05/03/2020 by Omoifo Darlington

Groups:

◇ hurdles to further advancement

- **project estimation: time dependent**

Created: 05/03/2020 by Omoifo Darlington, Modified: 05/03/2020 by Omoifo Darlington

Groups:

◇ source of CV learning & Improvement

- **RE benefits: customer understanding**

Created: 05/03/2020 by Omoifo Darlington, Modified: 05/03/2020 by Omoifo Darlington

Groups:

◇ RE challenges, importance & benefits

- **RE challenge:working culture difference**

Created: 05/03/2020 by Omoifo Darlington, Modified: 05/03/2020 by Omoifo Darlington

Groups:

◇ notable RE challenges

- **RE importance:emergent**

Created: 03/03/2020 by Omoifo Darlington, Modified: 05/03/2020 by Omoifo Darlington

Groups:

◇ RE challenges, importance & benefits

- **RE importance:most or one of the most**

Created: 03/03/2020 by Omoifo Darlington, Modified: 05/03/2020 by Omoifo Darlington

Groups:

◇ RE challenges, importance & benefits

- **RE: change Management**

Created: 05/03/2020 by Omoifo Darlington, Modified: 05/03/2020 by Omoifo Darlington

Groups:

◇ hurdles to further advancement ◇ notable RE challenges

- **RE: good practices knowledge**

Created: 05/03/2020 by Omoifo Darlington, Modified: 05/03/2020 by Omoifo Darlington

Groups:

◇ hurdles to further advancement ◇ notable RE challenges

- **RE: must deliver value**

Created: 05/03/2020 by Omoifo Darlington, Modified: 05/03/2020 by Omoifo Darlington

Groups:

◇ CV unique - most valuable

- **RE:process definition**

Created: 05/03/2020 by Omoifo Darlington, Modified: 05/03/2020 by Omoifo Darlington

Groups:

◇ hurdles to further advancement ◇ notable RE challenges

- **requirements gathering**

Created: 05/03/2020 by Omoifo Darlington, Modified: 05/03/2020 by Omoifo Darlington

Groups:

◇ elicitation challenge ◇ hurdles to further advancement ◇ notable RE challenges

- **requirements: management**

Created: 05/03/2020 by Omoifo Darlington, Modified: 05/03/2020 by Omoifo Darlington

Groups:

◇ hurdles to further advancement ◇ notable RE challenges

- **resource limitation**

Created: 04/03/2020 by Omoifo Darlington, Modified: 05/03/2020 by Omoifo Darlington

Groups:

◇ high level hierarchical challenges

- **respondents background**

Created: 05/03/2020 by Omoifo Darlington, Modified: 05/03/2020 by Omoifo Darlington

Groups:

◇ personnel & company background

- **roadmaps: planning ahead**

Created: 05/03/2020 by Omoifo Darlington, Modified: 05/03/2020 by Omoifo Darlington

Groups:

◇ source of CV learning & Improvement

- **shared experience or knowledge challenge**

Created: 03/03/2020 by Omoifo Darlington, Modified: 05/03/2020 by Omoifo Darlington

Groups:

◇ source of CV learning & Improvement

- **simplicity**

Created: 03/03/2020 by Omoifo Darlington, Modified: 05/03/2020 by Omoifo Darlington

Groups:

◇ RE challenges, importance & benefits

- **software is information business**

Created: 05/03/2020 by Omoifo Darlington, Modified: 05/03/2020 by Omoifo Darlington

Groups:

◇ expanding customer knowledge

- **software process challenge**

Created: 05/03/2020 by Omoifo Darlington, Modified: 05/03/2020 by Omoifo Darlington

Groups:

◇ hurdles to further advancement ◇ source of CV learning & Improvement

- **software process: iterative (agile) case**

Created: 03/03/2020 by Omoifo Darlington, Modified: 05/03/2020 by Omoifo Darlington

Groups:

◇ expanding customer knowledge

- **software process: pure waterfall case**

Created: 03/03/2020 by Omoifo Darlington, Modified: 05/03/2020 by Omoifo Darlington

Groups:

◇ expanding customer knowledge

- **stakeholders**

Created: 03/03/2020 by Omoifo Darlington, Modified: 05/03/2020 by Omoifo Darlington

Groups:

◇ CV unique - most valuable

- **stakeholders:value chain**

Created: 03/03/2020 by Omoifo Darlington, Modified: 05/03/2020 by Omoifo Darlington

Groups:

◇ CV unique - most valuable

- **startup culture advantage: faked by larger firms**

Created: 05/03/2020 by Omoifo Darlington, Modified: 05/03/2020 by Omoifo Darlington

Groups:

◇ business value of customer

- **technical debt**

Created: 03/03/2020 by Omoifo Darlington, Modified: 05/03/2020 by Omoifo Darlington

Groups:

◇ high level hierarchical challenges ◇ notable RE challenges

- **technical knowledge: business challenge**

Created: 03/03/2020 by Omoifo Darlington, Modified: 05/03/2020 by Omoifo Darlington

Groups:

◇ high level hierarchical challenges

- **technical knowledge challenge**

Created: 03/03/2020 by Omoifo Darlington, Modified: 05/03/2020 by Omoifo Darlington

Groups:

◇ high level hierarchical challenges

- **technical knowledge: multidisciplinary advantage**

Created: 05/03/2020 by Omoifo Darlington, Modified: 05/03/2020 by Omoifo Darlington

Groups:

◇ hurdles to further advancement

- **telemetry**

Created: 03/03/2020 by Omoifo Darlington, Modified: 05/03/2020 by Omoifo Darlington

Groups:

◇ expanding customer knowledge

- **telemetry challenge**

Created: 03/03/2020 by Omoifo Darlington, Modified: 05/03/2020 by Omoifo Darlington

Groups:

◇ hurdles to further advancement

- **training personnel challenge**

Created: 03/03/2020 by Omoifo Darlington, Modified: 05/03/2020 by Omoifo Darlington

Groups:

◇ hurdles to further advancement ◇ notable RE challenges ◇ shocking customer realities for small SW firms

- **unknown customer needs**

Created: 03/03/2020 by Omoifo Darlington, Modified: 05/03/2020 by Omoifo Darlington

Groups:

◇ customer needs complexity, expectations and reality ◇ elicitation challenge

- **usability need customer centred design**

Created: 03/03/2020 by Omoifo Darlington, Modified: 05/03/2020 by Omoifo Darlington

Groups:

◇ customer needs complexity, expectations and reality

- **useful feedback**

Created: 03/03/2020 by Omoifo Darlington, Modified: 05/03/2020 by Omoifo Darlington

Groups:

- customer needs complexity, expectations and reality

[Appendix F — Relations & Quotation Links](#)

ATLAS.ti Report

New Improving CV Co-Creation through Customer Engagement & Good RE Practices

Quotation quotation links

Report created by Omoifo Darlington on 17 May 2020

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