

Layered CRM Architecture For Big Data Integration

Mona Lilly Raggad, Graduate Program

Lubin School Of Business

Pace University, New York

Abstract

CRM claims great business advantages: strategic, functional, and operational. These advantages, when present, can provide for customer loyalty, customer advocacy, and customer lifetime value. Unfortunately, without integrating big data into CRM, the claim of strategic business advantages cannot be proven. This deficiency is simply due to data insufficiency when CRM is not connected to big data. Through the adequate integration of big data and with the right data analytics, the CRM can produce valuable strategic insights, including customer centricity, agile resilience, sustainability, and innovation, in addition to above standard benefits.

This paper discusses the big data integration process and the minimal integration needed achieve the intended business advantages and CRM benefits. It is consequential that the integrated CRM model aligns with CRM governance conditions which require that 1) the CRM integrated architecture aligns with the accepted management rules that organizes management into strategic, functional, and operational level, 2) that the data management CRM effort at the operational level remains independent of the functional and strategic managerial levels, and 3) all the big data V's have to resolved.

We propose a layered approach that divides CRM into three independent layers: the Customer relationship Strategic Management (CRSM) layer, the Customer Relationship Functional Management (CRFM) layer, and the Customer Relationship Operational Management (CROM) layer. The paper will discuss the design and implementation requirements of the integrated CRM model and its strategic benefits.

Keywords: CRM, CRSM, CRFM, CROM, strategic, functional, operational, big data, cloud computing.

Date of Submission: 21-04-2024

Date of Acceptance: 01-05-2024

I. Introduction

The CRM utility is primarily strategic even though most data processing takes place at the operational level in the management hierarchic structure. CRM data processing initially allows us to identify, personalize, track, and review and reconfirm leads and customers, but also provides for more central steps like customer loyalty, customer advocacy, and customer lifetime value in addition to more strategic values defined by upper management.

The origin of an enterprise's profitability is its educated customers and if an enterprise can build a continuous direct relationship with them, it will certainly secure a great and lasting revenue generation power. The CRM technology is designed for the purpose of maintaining such a relationship and it is certainly the central core of any sound attempt to plan and retain a business value generation capability. CRM is indeed a business strategy that an enterprise has to implement in order to secure a lasting business continuity. Unfortunately, the CRM technology continues to fail over and over and for a variety of reasons. About 70% of the failure can be traced back to low quality of data and the uncertainty associated with it in addition to the data high cost [1]. The literature also shows that this failure continues and is also due to poor planning and the ambiguity of tasks in relation to the core of business [3]. Even though CRM still remains a necessary tool in business health and wealth, still about 75% of CRM implementations fail to yield the intended business value generation capabilities [2]. Important causes of CRM failure relate to ineffective business strategy, CRM alignment with Management structure, and improper integration of CRM in the enterprise business environment [4] in addition to the reasons above.

II. CRM Data Management

The CRM database contains 5 types of data: identification data, descriptive data, probe data, transactional data, and conversed data [6]. Table 1 gives examples of parameters for which data is collected. Identification data concerns parameters that identify the customers, like customer number, name, email, etc. Descriptive parameters are concerned with those variables that define some properties of customers, like their titles, marital statuses, etc. Probe parameters give the preliminary explorative effort that identifies and selects products to acquire, and also inquiries and complaints that will negatively affect the relationship between the customer and some of the products of interest. Transactional data concern parameters that trace all purchase

transactions and other events that lead to purchases. The conversed data is concerned with data collected on customer behaviors through surveys, questionnaires, or satisfaction instruments.

Table 1: Example of CRM data

CRM data versus Managerial levels		
Types of CRM data	Example of data parameters	CRM Purpose
Identification data	Cust ID number; Names; Email; Phone; DoB; Address; etc.	Operational
Descriptive data	Educ level; Title; Marital status; etc.	Operational
Probe data	Number of inquiries; Number of visits; Number of complaints; etc.	Mostly functional
Transactional data	Total purchase; Number of promotional events; Number of products purchased; etc.	Mostly operational Pseudo functional Pseudo strategic
Conversed data	Data from interviews; Data from surveys; Satisfaction data; Preferences data; etc.	Pseudo strategic

The most consequential part in Marketing management is its CRM system, and the most consequential part of the CRM system is its strategic component. As you can see, the CRM system only uses a very limited set of data that is stretched beyond its capacity to produce the intended strategic decision support [7]. With the integration of big data in the CRM system, we now can process many important strategic matters like sustainability, innovation, and customer centricity, and agile resilience, Most CRM data, as shown in Figure 1, concern customer demographics and customer behavior. The customer behavioral data mostly includes customer purchases and preferences. This CRM data is very useful to produce insights about customer behavior and preferences but does not go much beyond that to provide a more significant strategic decision support and to produce useful recommendations in relation to central strategic factors like customer lifetime value, innovation, and product and service redesign.

That is, any strategic decision support in CRM remains very little and very unprecise. The pseudo strategic contribution we see in the CRM decision support effort to customer loyalty, customer advocacy, and customer satisfaction is simply insufficient. This CRM system just does not have the data needed to process and produce the needed strategic decision support. In order to achieve this strategic decision support, the integration of big data into the CRM becomes really necessary. But this big data integration, in its turn, requires a change in CRM architecture, one that makes the data management effort fully independent of any functional and strategic activities in the CRM system. We, later in this study, propose a layered CRM architecture where big data integration takes place in a data layer that remains completely independent of the above CRM managerial layers.

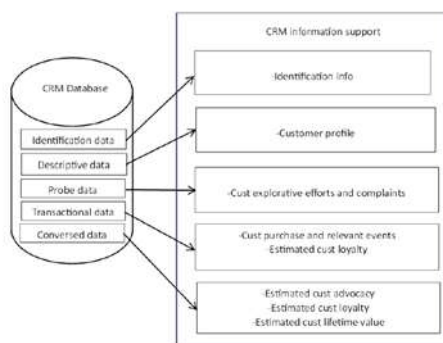


Figure 1: CRM database

Big data

An enterprise’s big data is a continuous flow of raw data, generated from a variety of sources, with unknown veracity, unknow value, and large variability, both structured and unstructured, in large volumes and at a high velocity [5]. These sources include websites, social networks, mobile apps, software, documents, computer logs, sensor networks and many more. The unstructured data may come in text, audio, or video forms, or in other formats that have to be datafied before data analytics can be performed to generate useful and actionable business insights.

That is, big data is a multiple-source high-speed generator of an immense volume of structured and unstructured data, with great variability, unknown veracity, and unspecified value. The feasibility and the utility of this the multiple-source data generator are really unknown until the right rigorous data analytics uncovers its advantageous value.

The CRM system is indispensable to advance customer analysis. The big data will be needed to capture extended raw data that can be processed to analyze online data from social media, transactional logs, and email traffic. Big data analytics will allow for predictive intelligent modeling about customer behavior and enterprise resource planning. For example, the big data will provide valuable insights necessary to refine the planned marketing steps to increase customer engagement and conversion levels.

The main feature that distinguishes big data from other data stores is its volume. Large amounts of data are generated in a continuous manner. Storage solutions of such an abundance of data are not easy to implement. Furthermore, the data analytics that produces the intelligent decision support we need remains a great challenge. Velocity comes next after the volume feature in big data. Structured and unstructured data arrives at a high speed, which will make the volume problem even graver. Because of the high-speed data generation, the volumes fill more rapidly. At a high speed, we rapidly amass more than the amounts of data we need for data analytics. Unfortunately, because of this velocity feature in big data, the findings the data analytics produced earlier may not be valid a little later.

Variety is another annoying feature in big data because data comes from different sources in different formats. This will considerably affect the effectiveness of the data analytics since what works for one data format may not work for the other. To remedy for this inconvenience, data conversion is needed but its preparation may be costly. The standard preparation effort where data comes structured may not be adequately available in big data since 80% of it will be unstructured. This type of process will concern unstructured data as in images, videos, emails, social network comments, etc.

The veracity feature in big data concerns the accuracy of its data that cannot be guaranteed. This means that unless the data is validated before its processing, the business insights produced may be invalid. Data integrity before the arrival of data, from big data, and its transmission and storage is very consequential to produce acceptable actionable insights. The veracity of data refers to its accuracy and credibility. Data must be validated to verify that it truly reflects critical business operations, and that any data processing, modeling, or evaluation has no impact on the data's accuracy. This is also the reliability or integrity of the data that a business receives and processes to draw relevant insights. Most often, the veracity in big data depends primarily on its origin and its storage and transmission process.

The big data technology, as depicted in Figure 2, still remains a great wealth of information despite it V's features. This wealth of information is certainly invaluable for delivering stronger customer service and driving sales growth. The integration of big data in CRM creates the power of learning to spot buyer signals and to create a greater decision support power for better sales and marketing decisions. Big Data has the ability to empower CRM by providing actionable data, advanced CRM tools, and real-time insights. This will add the capability to analyze customers' behavior, identify sales opportunities, and engage them in personalized activities, thus leading to better products, better services, and better data management.

The CRM database, as shown in Figure 2, before integration, is organized into an inefficient manner and the data roles are not well defined in terms of managerial requirements. The CRM data, as is, is not processed to fully benefit the CRM component intended for it. The CRM data that applies to operational management, functional management, or strategic management is not prepared for the type of activities planned. This will make it difficult to manage the uncertainty and the inconsistencies associated with CRM data and induce valid confidence factors associated with the produced business insights.

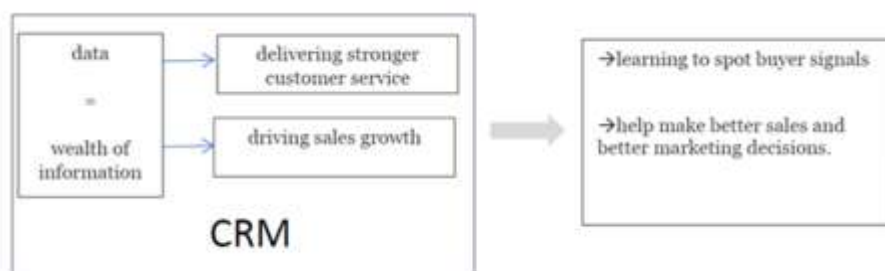


Figure 2: CRM wealth of information

Information associated with operational data has to be very precise while functional data may be summarized and approximated in terms of its utility in providing the functional decision support meant for. Strategic decision support information must be however more aggregated and valid throughout the longer term. The CRM data, before big data is integrated, cannot produce sufficient confidence in planning strategic CRM components and goals. To achieve an acceptable strategic predictive power for customer loyalty, customer advocacy, customer life value and other useful strategic objectives, the CRM structure need to align with the management structure of the enterprise. In a small business case, the proposed CRM layers can be overlapped as needed.

The big data, however, when integrated with CRM can support CRM by adding a greater predictive power. The integration process should align with corporate governance. Most CRM data before integrating big data is directly linked to functional and operational management but very little with strategic management while the big data is instead more concerned with strategic management.

Strategic management in an enterprise concerns the definition and the implementation of its goals and objectives. This will require a clear strategy and a clear strategic plan to define the resources needed to achieve the enterprise vision, mission, and strategic goals in terms of customers, competitors, capabilities, and budget requirements. This strategic planning will define the corporate vision for the future and its goals and objectives and establish the steps leading to the realization of those goals and vision. The steps will include the assessment of the corporate strategy, define the goals and objectives, develop the strategic plan and its metrics, and implement and continuously review the process.

Functional management is situated below strategic management and is responsible for defining a clear functional plan to execute all the agendas and directives defined by strategic management. They are only concerned with controlling and running the enterprise as established by upper management and are not necessarily concerned with strategic decisions.

Functional management are often middle management executives that oversee the running of the enterprise's main functional units, namely, Human Resources, Finance, Marketing, Manufacturing/Production, and Information Services. That is, functional planning is concerned with specific functional units that support the midterm goals of the enterprise.

Operational management will have their own operational plan to execute the functional directives defined by functional management. They will be responsible for the management of short-term business structure, practices, and processes to conduct day-to-day business operations.

III. Proposed Model: CRM Layered Architecture

Management theory divides management into 3 levels: the upper level is strategic management; the middle management is functional management; and the lower-level management is operational management [8]. Upper management defines strategic directives that middle management should follow in conducting functional management. Functional management, in its turn, defines the functional directives that lower management should follow in conducting operational management. The functional directive should align with strategic directives defined by upper management. The functional directives will indicate what the operational management level should execute to achieve the goals and objectives set in the functional directives. CRM should align with this hierarchic structure.



Figure 3: Data, Information, and Knowledge in CRM management layers

Given the CRM conceptual framework described in Figure 4 that aligns with the hierarchic management layers studied in Management theory, we propose a new CRM layered architecture that divides CRM into three CRM layers: Customer Relationship Strategic Management (CRSM), Customer Relationship Functional Management (CRFM), and Customer Relationship Operational Management (CROM). The CRM strategic layer is concerned with CRM strategy; the CRM functional layer is concerned with CRM functions; and the CRM operational layer is concerned with CRM operations.

We propose that the CRM system must be reorganized in three layers: the strategic layer, the functional layer and the operational layer. The CRM strategic layer will define CRM governance and policies and will define goals and objectives for data processing that assures more profitable strategic decision capabilities. The functional layer of the CRM system will oversee conducting functional management activities as defined by CRM strategic directives, as depicted in Figure 5. This CRM middle level will define the data parameters, their measurement, and the methods we use in data collection. This data is used to produce intelligent actionable business insights while aligning with the CRM strategic directives defined at the upper CRM layer

The CRSM layer produced strategic directives that are transmitted to the CRFM layer to execute. The CRFM layer produces functional directives that are transmitted to the CROM layer to execute. The operational directives are executed in the CROM layer where data collection takes place.

For example, the CRSM layer selects strategic variables, like customer loyalty, customer advocacy, customer lifetime value and defines strategic directives with clear goals and objectives. The CRFM layer defines data and its collection methods. The CROM layer will proceed to perform the measurements and data collection as defined in functional and operational directives. The operational managerial layer consists of CRM data processing after big data is integrated.

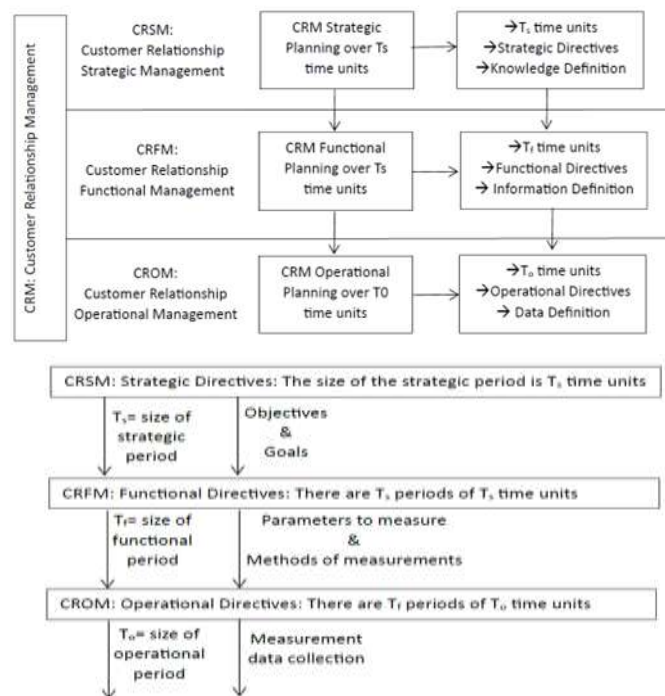


Figure 5: Layered approach to integrate big data into CRM

The lower CRM layer is concerned with the operational management activities within the CRM system to execute the measurement and data collection for the data parameters defined in the functional directives. The proposed layered architecture of the CRM system, as depicted in Figure 4, will allow us to reorganize CRM data into a layout that enhances this strategic, functional, and operational decision support capabilities to achieve CRM goals and objectives.

IV. Big Data Integration

CRM needs to include big data where we can dig deeper in the volumes of raw data until actionable insights are found. The structured data part of big data may not however be sufficient to produce the intended actionable insights and an effective datafication program may be still needed to mine for the valuable intelligent hints to produce craved smart actionable insights. Figure 6 depicts the need of datafication as much as possible to provide more structured data for data analytics.

The CRM concept is an example of technology that can turn big data into a very valuable decision support system. When integrated in CRM, big data will add the capability to process, store and analyze massive amounts of structured and unstructured data and rely on to gain additional actionable insights. Big data, however, despite its great advantage in producing intelligent decision support, brings along some annoying features referred to as the V's, including volume, velocity, variety, variability, and veracity. The data we usually find in CRM is mainly demographic in addition to purchases information. But with the integration of big data, we now have all varieties of raw data continuously streaming from almost anywhere including from the web, business applications, and machine logs. This raw data from bigdata can help businesses grow and become strategic and profitable.

The integration of big data in CRM is however straightforward and the CRM concept itself has to be reviewed and its architecture reevaluated. While the literature seems to accept that the CRM is a well-established concept that aligns the very well-established theories of management. For us, however, there is no universal and tenured theory of management that comes without some shortages. It is important to note that when Weber, Fayol, and Mintzberg [8] reviewed older theories of management and established their newer theories of management, the ones we use now, there was no data role and no cyber role studied in any theory of Management, simply because, at that time, there was no internet and no digital transformation for which those roles are needed. That is, basing the CRM concept solely on the current Management theory is not sufficient and CRM has to be redefined at the presence of new data and cyber managerial roles that were not known decades earlier. The cyber and data roles in digital transformation and big data must be considered when the CRM concept is reevaluated in this paper.

The integration of big data and CRM is consequential for the generation of personalized customer services. This will bring a more comprehensive view of customers that can enable us to provide personalized customer services, improve customer loyalty, customer satisfaction, and customer advocacy, and boost revenue growth.

Even though big data will add to the CRM the needed quantity of data, it is still not sufficient to achieve the CRM strategic decision support we need. The CRM system, even with the quantity of data secured, still needs to be reorganized in terms of their use and in terms of the managerial levels we recognize in the organizational structure of the enterprise. Without the reorganization of CRM data we will not be able to tell which data and how much of it we will need to process the selected strategic variables, as customer advocacy and loyalty in order to produce more intelligent actionable insights.

As shown in the management hierarchic pyramid, managers at different levels process different conceptual resources: the strategic level processes knowledge, the functional level processes information, and the operational level processes data. Even though these conceptual resources are related the managerial levels still conduct independent decision processes and the CRM should be reorganized accordingly. Data is processed to produce information and information is processed to produce inferences that become knowledge after sufficient testing and validation.

That said, for the big data integration to work as intended, all its V's have to be resolved. Very important questions have to be answered:

V1: Volume feature: Do the business insights we just produced remain valid when more data arrives?

V2: Velocity feature: Do the business insights we just produced remain valid a bit later?

V3: Variety feature: Do the business insights we just produced remain valid when the formats of some of the new facts are not included? Can they infer inconsistent insights when processed?

V4: Variability feature: Do the business insights we just produced remain valid when we observe a large variability in the data?

V5: Veracity feature: Do the business insights we just produced remain valid when some data come from unknown sources?

V. CRM Data Population

The proposed integrated CRM model redefined CRM as three-layered CRM components called CRSM, CROM, and CROM. The CRSM component is responsible for CRM governance and marketing strategic decision support. The CRFM component is responsible for CRM functional marketing decision support including parameter and data definition. The CROM component is responsible of measurement, data collection, and integrated data analytics. All data processing activities take place in the Customer Relationship Operational Management component, as shown in Figure 4 above.

CRM needs to include big data where we can dig deeper in the volumes of raw data until actionable insights are found. The structured data part of big data may not however be sufficient to produce the intended actionable insights and an effective datafication program may be still needed to mine for the valuable intelligent hints to produce craved smart actionable insights. Figure 6 depicts Raggad's taxonomy and the need of datafication as much as possible to provide more structured data for data analytics [5].

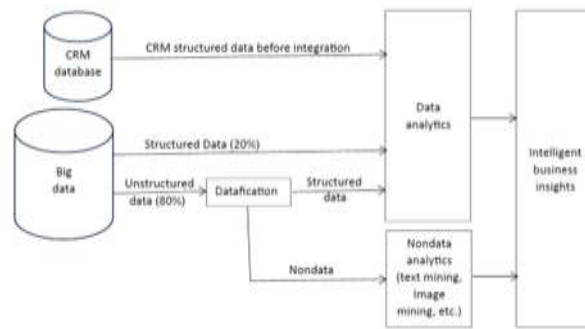


Figure 6: CRM integrated data analytics

VI. Future Research Directions

When the proposed CRM layered architecture was discussed, one may notice that at the lower layer there is a small CRM, called CROM, in charge of data management where data is collected and processed; in the middle layer, there is a smaller CRM, called CRFM, in charge of functional activities where data and methods are defined; and in the upper layer, there is a small CRM, called CRSM; in charge of CRM governance and where customer strategic variables are all defined and planned. This paper did not discuss the design of those CRM subsystems. This is a very important problem to study.

We also discussed that unless all the big data V's are resolved, the big data integration in CRM may not yield the intended strategic benefits. This is also a very important problem to study.

The authors believe that a random navigation coupled with a random data extraction process in the big data, followed by sound data analytics, may be a remedy to most of the V's. The V's are resolved when we start observing that the produced business insights tend to an acceptable value that does not change much when new data comes.

VII. Conclusion

CRM continues to claim great business advantages, strategic, functional, and operational. These advantages, when present, can provide for customer loyalty, customer advocacy, and customer lifetime value. We argued that these claims cannot be validated without integrating big data into CRM. The study argued that even with integrated big data, the CRM system still has to be redefined and should align with management theory. It also must be reconfigured in a three-layered architecture that makes the data processing effort independent of any higher management activities.

This new CRM architecture will view the CRM as three layered CRMs: Customer Relationship Strategic Management (CRSM), Customer Relationship Functional Management (CRFM), and Customer Relationship Operational Management (CROM).

References

- [1] Eckerson, W. (2002). Data Quality And The Bottom Line: Achieving Business Success Through The Commitment To High Quality Data. The Tdwi Report Series., Tdwi.
- [2] Farhan, M. S., Et Al. (2018). A Systematic Review For The Determination And Classification Of The Crm Critical Success Factors Supporting With Their Metrics. Future Computing And Informatics Journal, 3(2), 398-416.
- [3] Foss, B. Et Al. (2008). What Makes For Crm System Success Or Failure?," Journal Of Database Marketing & Customer Strategy Management, Vol. 15, Pp. 68-78.
- [4] Papadopoulos, T. Et Al. (2012). The Criticality Of Risk Factors In Customer Relationship Management Projects. Project Management Journal, 43(1), 65-76.
- [5] Raggad, B., (2021) Big Data In The Economy Of Things: The V's And The Anti-V's, Iosr Journal Of Electronics And Communication Engineering, 16(4), Pp 33-53.
- [6] Resuello, L.D. (2024). What Is Crm Data? 4 Types Of Data To Store In Your Crm. <https://fitsmallbusiness.com/crm-data/what-is-crm-data/>
- [7] Shojaei, A. S. (2015). Critical Success Factors OfCrm: Antecedents To Successful Implementation. Management Innovator, 8(1), 105-131.
- [8] Wamalwa, P. (2023) Introduction To Management Theory. Publisher: Syntec Publishers; Isbn: 978-9914-49-