

Modeling Marketing Information System Platform Using Computation Independent Model (CIM)

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Abstract- This paper presents an innovative approach that combines digital marketing (DM) and model-driven architecture (MDA) to develop a personalized information system platform for companies, filling a gap in the literature. Our approach integrates funnel marketing concepts and MDA levels. While digital marketing and MDA have been extensively researched separately, there is a lack of research that combines these two fields to provide personalized, data-driven, functionalities feedback systems for companies. To establish the novelty of our approach, we used the Computation Independent Model (CIM), (MDA contains three levels: CIM, PIM and PSM) to model the future platform. We found that company leaders did not know what type of platform to build, in what type of situation, what pages, what order and what sequences. Our novel approach has the potential to revolutionize the field of marketing and especially the digital marketing by providing personalized, data-driven models, the strategy and tactics behind the digital marketing platforms.

Keywords: Digital marketing modeling, model-driven architecture (MDA), Computation Independent Model (CIM) and funnel marketing.

I. INTRODUCTION

A digital marketing information system platform involves managing the organization's presence on all media and online platforms (websites, search engines, social networks, mobile applications, emails, etc.). The information we talk about is customer-oriented, purchase orders, deliveries, etc. These various technologies allow to reach new customer recruitment objectives, but also to retain current customers and to develop the e-reputation of a company.

On the other hand, models are used by many disciplines. For example, economists use models to describe and predict market behavior, sociologists and psychologists use models to understand human behavior and diagnose anomalies, and architects build models to analyze the structural integrity of buildings and their possible failures.

In information systems and software platform engineering, the use of models has some unique features. Firstly, models

are used to give explicit form to software platform, which is immaterial in nature. Secondly, the concepts and tools used to express models and define software implementations are the same. As a result, developers don't have to face the added complexity of changing media when moving from models to implementations. This has led, in particular, to the emergence of automated model transformations in the field of model-driven engineering.

Models are used to describe a system that is to be developed in the future, and are therefore constructive. They are used to address complexity. Their objective is to create a product according to the model's specifications. In other words, the model acts as a roadmap. In general, models are represented graphically. This may be convenient for the people who manipulate them. The structure of the models must be formally described. Metamodeling provides a formal description of models. This description is itself a particular model called a metamodel.

In this paper, the modeling of such a platform is based on:

- The funnel model refers to the consumer conversion funnel for a given product category and/or brand. The idea behind it is that a certain number of people will start a buying journey, but only a part of them will end up at the end of the process [5][6].
- The components of the model: Customers, communication channels, platform resources, etc. [3][11].
- Model Driven Architecture: We mainly use the first level of MDA, i.e., the CIM level: Computation Independent Model [4][8][12][16].
- UML: Unified Modeling Language. We mainly use two diagrams: the activity diagram and the use case diagram. In this paper, the CIM level for modeling the digital [4]. marketing funnel concept consists of these two diagrams.

Our work is to build an integrated digital marketing model for digital platforms. The ultimate goal of marketing is to reach a consumer at the various moments that will be important in his or her purchasing decision. After studying

several articles and books, we have concluded that the funnel approach is a preferred approach for modeling digital marketing-oriented platforms.

Another approach is called "consumer journey" proposed by the McKinsey consultancy firm [15] and is presented as an alternative to the "funnel", taking into account the new ways of integrating information at the different stages of the purchasing process. For the IT design of digital marketing platforms, we have opted for functional modeling of the different blocks of our platform. This functional modeling is function-oriented. It does not include the specific programming features; this work is done by the software developers. At the MDA level, this modeling is equivalent to the CIM level. The modeling we're talking about focuses on the business modeling of the digital marketing platform. In this sense, there are three main modeling methods. The first method is focused on the diagram activity which is a UML diagram [4]. The second is based totally on BPMN: Business Process Model and Notation [28]. The third is based on DFD: Data Flow Diagram [29]. All the three approaches are used for the CIM level. But we opted for the first because it's easy to use, and it's also very simple to switch from the first method to the second. By combining the two fields of digital marketing and MDA modeling (Specifically CIM level), the leaders can realize that this was the missing piece. They had a vision. Now they have a platform on a strategic and tactical level: the ingredients to put in what order to create that platform. This work will identify all the elements needed to build that platform. It will show all the pages needed to build it. But this work also focuses on the strategy of this platform. This paper is structured as follows: Section 2 presents related work on digital marketing and model-driven architecture (MDA). This section details an effort to combine MDA and digital marketing. Analysis of these articles is also presented. In section 3, we present the two most commonly used concepts in digital marketing, namely the funnel and the consumer journey. We also present the MDA approach and its three levels: CIM, PIM and PSM. In section 4, we present the components of the funnel model. It's about the funnel concept itself and its components, i.e., the pages and their categories. The elements that make up the pages are also presented. In Section 5, we have relied exclusively on UML to implement the approach adopting the UML activity diagram to model business processes at the CIM level. We have also discussed the BPMN and DFD standards for modeling the process of digital marketing platforms at the CIM perspective. Finally, we conclude with a synthesis of our paper and present our future work.

II. RELATED WORK

In this article, we aim to integrate two distinct fields of research, digital marketing and modeling via MDA and

especially CIM model and explore the potential benefits of combining these two fields. Both digital marketing and MDA have been the subject of extensive research, with numerous studies investigating various aspects of these disciplines. Unfortunately, studies are separate. They don't take today's reality into account. To our knowledge, there are no papers that combine MDA and the funnel. So, the article closest to our research is (Mohamed Taleb et al., 2007). The models presented in this article present several levels of abstraction such as business, task, dialog, presentation and layout models. The proposed architecture shows how several individual models can be combined at different levels of abstraction into heterogeneous structures, which can be used as building blocks in the development of Web applications. There are also others similar articles (Y. Rhazali et al. 2016a), (Y. Rhazali et al. 2014) and (Y. Rhazali et al. 2016b), (Yasser Lamlili et al., 2013). All these articles focus on web applications in general. These articles have the advantage of using MDA, but do not take into account the particularities of digital marketing. Additionally (Sarra Roubi et al., 2015), the authors adopted to demonstrate the tandem of the MDA and HCI (Human Computer Interface). Based on the MDA approach and its principles, they elaborate the Platform Independent Model (PIM) to describe the interface's functionalities and not using just a simple Unified Modeling Language (UML) diagram. Other authors, such as those (Meryem Fakhouri Amr et al. 2021) have used MDA approach in order to propose a new method and new transformation rules for optimization of the business process "COVID-19 patient management". This article uses MDA but in a context that is not close to digital marketing. It applies MDA to the Covid-19 management process. The research (Farzad Malek shirabadi et al, 2022) aims to design an integrated model for digital marketing based on marketing intelligence. The research uses mixed-methods descriptive survey design which is not closely related to the MDA approach. The study (Jose Ramon Saura, 2021) aims to review methods of analysis, uses, and performance metrics based on Data Sciences as used in digital marketing techniques and strategies. The review concludes with formulating recommendations on the development of digital marketing strategies for businesses, marketers, and non-technical researchers and with an outline of directions of further research on innovative Data Mining and knowledge discovery applications. Once again, this paper does not incorporate the MDA approach. The authors (Meryem Boufim et al., 2021) propose in this paper a maturity model for digital marketing strategy implementation to help marketers and organization in their implementation journey. The goal of using maturity model is to help enterprises identify the current situation and identify the correspondent path of evolution to reach the desired situation. The proposed

maturity model identifies five stages of growth: initiation, expansion, formalization, integration, and maturity, along with nine benchmark variables: strategy, resources/Skills, organization, control, communication, culture, digital identity, customer knowledge, and technology. In (Peter C. Verhoef and Tammo H.A. Bijmolt, 2019), the authors discuss the relevance of digital business models and discuss how digital business models affect firms, firm performance, and markets. They introduce and show how they each fit within the conceptual framework. In (Katrijn Gielens and al., 2019), they discuss four types of digital (dis)intermediation, and how they affect branding activities of incumbents and new firms. They present issues in need of future research for each type of digital (dis)intermediation. They conclude with an appeal that marketing takes the lead in developing overarching, indigenous theories of digital (dis)intermediation to make sense of the rapid changes in the marketplace.

In conclusion, these articles show that the MDA approach and digital marketing has been used extensively. We have not found any articles that combine the two dimensions. Our work is perhaps one of the first articles to combine the specificities of digital marketing with the MDA approach.

III. BACKGROUND KNOWLEDGE:

A. THE FUNNEL AND CONSUMER JOURNEY

The ultimate goal of marketing is to reach a consumer at the different moments that will be important in his buying decision. Marketing wants to reach the consumer at the right place, at the right time, with the right message. The complementary approaches of the funnel and the consumer journey offer a way to analyze the buying paths of individuals and to identify step by step all the potential contacts to be made with a target (Simon Kingsnorth et al. 2022)

The funnel literally translates into the term "funnel". More precisely, it refers to the consumer conversion funnel for a given product category and/or brand. The idea behind it is that a certain number of people will start a buying journey, but only a part of them will end up at the end of the process [5][6].

The funnel is based on the principle that the consumer keeps in mind a set of possible brands for his purchase at the beginning of his decision process. Marketing techniques can help them refine their choice to select the product they finally buy. We will try to measure the conversion rate during the passage from one stage to the next. Therefore, there are two key phases in the analysis of a funnel:

- Break down the purchase process into successive steps;
- Analyze the conversion rates

The analysis of a funnel for an online purchasing process is

an interesting tool because it measures precisely the flow from one phase to another; it is thus possible to identify the stages where the abandonment rates are high and to question what causes a process to stop at a given stage. Ideally, it is interesting to analyze the journey of a target consumer for a set of competing brands and to compare the different indicators to identify the right levers to activate.

The "consumer journey" proposed by the McKinsey consultancy firm (Katherine N. Lemon and al., 2016) is presented as an alternative to the "funnel", taking into account the new ways of integrating information at the different stages of the purchasing process.

According to the designers of the consumer journey, the funnel does not allow for the significant growth of product choices and the multiplication of digital media with a consumer who is increasingly demanding and informed. Moreover, we must take into account that communication is less and less unidirectional and more and more bidirectional and interactive, (Christina Kuehnl and al., 2019), (Mark S. Rosenbaum and al. 2017), (Gundars Kokins and al., 2021). From this point of view, the buying process is no longer linear but circular: the consumer's journey is now considered as a journey with five phases:

- Contrary to the funnel, the number of brands considered during this stage can increase and not only decrease as consumers seek information.
- Consumers no longer receive information from companies, but go and find out for themselves what people around them think.
- The purchase.
- Post-purchase experience.
- Loyalty

B. THE MODEL DRIVEN ARCHITECTURE (MDA)

Model Driven Architecture (MDA) is a software development approach that was first introduced by the OMG (Object Management Group, 2014), a consortium of over 1,000 companies. The MDA approach prioritizes high-level abstraction models and the transformation of one model to another. It aims to address the challenges of constantly changing, highly networked systems by promoting platform independence, domain specificity, portability, cross-platform interoperability, and productivity.

In the MDA approach, the software development process is driven by modeling the software system, and the OMG classifies four types of models for software construction: Computation Independent Model (CIM), Platform Independent Model (PIM), Platform Specific Model (PSM), and Code. The CIM represents the requirements for the future application, the PIM represents the business logic and

functioning of the system, and the PSM is linked to an execution platform. The MDA approach separates the business logic from the platform execution, making it easier to develop and transform models. The MDA (Model Driven Architecture) infrastructure is based on the definitions and assumptions set out in (Object Management Group, 2014). MDA proposes three levels corresponding to the three major phases of software development:

- **Computation Independent Model:** the CIM is a view of the system from a perspective independent of any computer object. It is the most abstract model representing system requirements. In other words, it models the needs the system is supposed to meet, while abstracting from how to do so. It uses terms from the domain to which it belongs to describe the specifications, which are often perennial.
- **Platform Independent Model:** the PIM is a view of the system from a platform-independent perspective. It describes the behavior and structure of the system whatever the platform, or at least for several platforms with similarities. It promotes the separation of concerns between system logic and implementation details.
- **Platform Specific Model:** the PSM is a view of the system from a perspective dedicated to the execution platform. This model combines the specifications of the PIM and those of the platform hosting the system. Although it is not executable, it contains details of the behavior and structure that can generate executable code.

We have just mentioned the three most important types of models for MDA: CIM, PIM and PSM. In future work, we may be interested in how important it is to establish traceability links between these models. In fact, MDA establishes these links automatically by performing model transformations. The model transformations recommended by MDA are essentially CIM to PIM and PIM to PSM. Code generation from PSM is not considered a model transformation in its own right. MDA also considers reverse transformations code to PSM, PSM to PIM and PIM to CIM.

IV. THE COMPONENTS OF THE FUNNEL MODEL

A. PAGE COMPONENTS: THE ELEMENTS

The building blocks of a funnel are what we call elements. Elements are all the ingredients that go into the pages. These are all of the things that can possibly go on the pages. It could be videos, headlines, images, countdown clocks, etc. One thing we need to know is some elements are only available on certain types of pages. For example, order form elements are only available on order form style pages. Membership elements are only available inside of membership pages, etc. We can consider the following types of elements:

- Text Elements like headlines, subhead lines, paragraphs,

and bullet lists.

- Media Elements like images, image popups, video popups, and audio players.
- Form Elements like buttons, input forms, select boxes, and text areas.
- Advanced Form Elements like SMS signup, billing address, shipping address, and surveys.
- Countdown Elements like countdown timers, minute timers, and day timers.

B. FUNNEL COMPONENTS: THE PAGES

All of the elements go onto a page. A page is a bunch of elements put together in a special order to try to get people to take a certain action. The elements are just ingredients that we put into each of these pages. For example, on a sales page we may have a logo element, a navigation bar element, a video element, and order button element. Those few elements create a sales page. An order page would be a different type of “cake” so it’s made up of different types of ingredients. In the following, we present the page categories:

- **Presell Pages :** Survey Page, Article Page, Presell Page.
- **Option Pages :** Squeeze Page, Reverse Squeeze Page, Lead Magnet.
- **Thank You Pages:** Thank You Page, Offer Wall, Bridge Page, Share Page.
- **Sales Pages:** Video Sales Page, Sales Letter Page, Product Launch Page.
- **OTO (One Time Offer) Pages:** Upsell Page, Downsell Page.
- **Order Forms:** Two Step Order Page, Traditional Order Page, Video Sales Letter.
- **Webinar Pages:** Webinar Registration Page, Webinar Confirmation Page, Webinar Broadcast Room, Webinar Replay Room.
- **Membership Pages:** Access Page, Member’s Area.
- **Affiliate Pages :** Access Page, Affiliate Area.

C. FUNNEL TYPES

A funnel is a series of pages put in a strategic order. The goal is to take the customer on a journey that makes them most likely to go from a prospect, to a customer, to a client. Each funnel is as a huge “cake”, and each of the pages we just learned about now become ingredients in these funnels. We can start to look at all of the possible types of funnels that we could create for every type of business and every type of situation. There are literally millions of possible variations, but we can find that there are types of funnels that cover almost every possible situation for almost any type of business or industry. We could tweak these funnels by adding presale pages, or adding more upsells, etc....

- **Funnel type #1:** These funnels are specifically for generating leads, applications, and contact information

from the future customers.

- Funnel type #2: These funnels are structured in a way to get someone to actually pay us inside of the funnel. They have integrated shopping carts, one click upsells, down sales and more.
- Funnel type #3: These funnels are for hosting events like webinars, automated webinars, etc.

In this paper, we will focus on funnel type#2. Here is an example of this type of funnel. It is so irresistible people have to purchase it. After they put in their credit card, we can then upsell them our more expensive products and One Click Upsells or Downsales. During Step One, a potential customer is asked for and submits their contact information. During Step Two, the potential customer selects their product and enters their credit card information. The real power of the two-step comes from the ability to follow-up with a potential customer if they didn't complete Step Two. Upsells and Downsales follow the first page to increase the Average Cart Value.

V. CIM APPROACH TO FUNNEL MODEL

We can model the CIM level by using BPMN: Business Process Model and Notation (Stephen A White et al., 2016). The main aim of BPMN is to provide a standard notation for company stakeholders. These include the business analysts who create and refine processes, the technical developers responsible for implementing them, and the business managers who monitor and manage these processes. As a result, BPMN serves as a common language that bridges the communication gap that frequently occurs between the design and implementation of business processes.

In order to facilitate modeling for designers familiar only with the UML: Unified Modeling Language (Pascal Roques, 2004), we have relied exclusively on this language to implement the approach adopting the UML activity diagram to model business processes at the CIM level. In this sense, the most widely used standards for modeling business processes are UML, with its activity diagram, and BPMN. Each standard has its own advantages in terms of business process modeling. For this reason, we have taken advantage of the benefits of each standard to model the business process of our approach. The Data Flow Diagram (DFD) can be used in our approach to model the business process in the CIM level, since it is a simple modeling standard based on a limited number of notations [30].

In this paper, we used the notations of the UML activity diagram to model business processes at the CIM level. We used the UML activity diagram to identify the actors and represent the business process as a set of activities. Activity

diagram notations are the ingredients of our CIM. To illustrate our work, we will take the example of the type 2 funnel: Funnel type #2. These funnels are structured in a way to get someone to actually pay us inside of the funnel. They have integrated shopping carts, one click upsells, down sales and more. Our activity diagram is a series of activities put in a strategic order. We consider the following activities:

- Doing order Activity: Customers must be able to access the order activity, where they can enter their contact details and the information required for payment and delivery. An order has been registered and sent to the Orders department. An encrypted transaction has been carried out with the external secure payment system and saved.
- OTO Activity: It's also known as an upsell activity. After someone puts in their credit card information to purchase a product, they will land on this activity. The system offers them a one-click upsell to add to their order. All they have to do is click "yes" and their credit card is automatically billed. People used to have to re-enter their credit card information on every upsell activity. This killed conversions. Generally, any time somebody purchases a product, the system should offer them something that will add more value to the thing they just purchased.
- Downsell Activity: The Downsell Activity is when an individual lands on when they say "no" to the OTO Activity. Typically, the Downsell activity is used to confirm the fact the individual didn't want OTO activity. Again, OTO stands for One-Time-Offer and it's essentially a special offer presented to an individual, only one time, which is right now.
- Offer wall Activity: The system use "Offer wall activity" when the system has other products or services in the product line. The system thanks customers for their initial purchase, then it gives them links to the other products or services for selling. The goal with an offer wall is to push the customer into the front end of other funnels.
- Treat order: When a customer places an order, the employees search for the products in the warehouses. They then pack and label the products. The products are then loaded onto the transport vehicle.

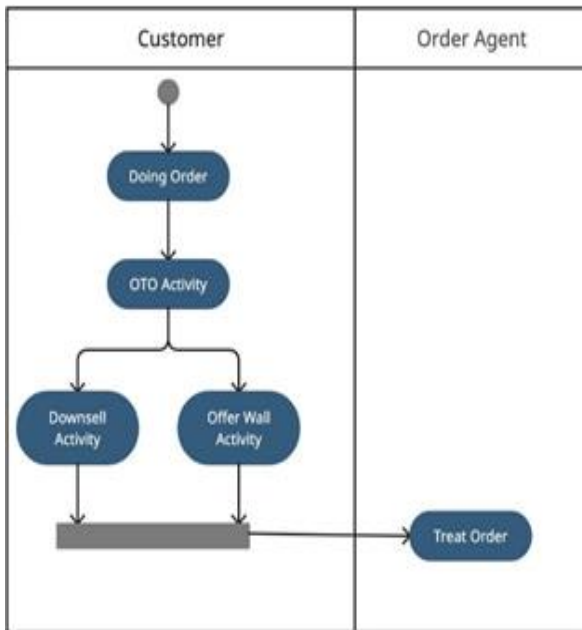


Figure1. The activity Diagram for our funnel type#2

To make the transition from the activity diagram to the use case diagram, we're going to use rules. But before presenting these transformation rules, we'd like to remind the basic concepts relating to the use case diagram. We use the following terms for use case diagrams (Pascal Roques, 2004):

- An actor represents a role played by an external entity (human user, hardware device or other system) that interacts directly with the system under study. An actor can directly consult and/or modify the state of the system, by sending and/or receiving messages that may carry data.
- A use case represents a set of sequences of actions performed by the system that produce an observable result of interest to a particular actor. A use case models a service provided by the system. It expresses actor/system interactions and provides "significant" added value to the actor concerned.
- An association is a relationship between UML elements (classes, use cases, etc.) which describes a set of links. It is used in the use case diagram to link actors and use cases actors and use cases with a relationship that simply means "takes part in".

To refine the use case diagram, UML defines three types of standardized relationships between use cases:

- An inclusion relationship, formalized by the <<include>> keyword: the base use case explicitly incorporates another, compulsorily.
- An extension relationship, formalized by the <<extend>> keyword: the base use case implicitly incorporates another, optionally.

Now, we present the following rules for moving from the activity diagram to the uses case diagram:

R1: Each activity corresponding to a system functionality is transformed into a "use case".

R2: Every "swimlane" becomes an "actor"

R3: Each "decision node" between two activities becomes an "extend" relationship between two "use cases".

R4: Each "control flow" between two activities becomes an "include" relationship between two "use cases".

After applying the following the rules, we will have this use case diagram:

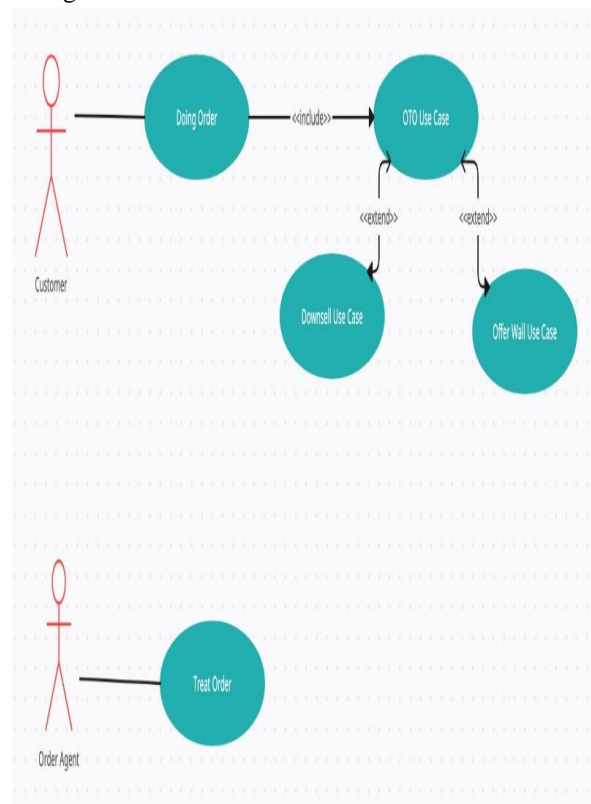


Figure2. The use case diagram for our funnel type#2

We can easily iterate to apply these transformations to different types of funnels. This work is very useful in the business modeling of digital marketing platforms. We used the CIM level for this business modeling. We preferred UML, and particularly the two diagrams: the activity diagram and the uses cases diagram. We can apply this work to other BPMN and DFD standards.

VI. CONCLUSION

This paper presents an innovative approach that combines digital marketing (DM) and model-driven architecture (MDA) to develop a personalized information system platform for companies. Our approach integrates funnel marketing concepts (Especially Type#2) and CIM level of

MDA. The most widely used standards for modeling business processes are UML, with its activity diagram, and BPMN. In order to facilitate the modeling task for designers who are only familiar with the UML language, we have relied exclusively on this language to implement our approach, adopting the UML activity diagram to model business processes at the CIM level. The data flow diagram (DFD) is a simple business modeling standard, because it is composed of a limited number of notations. It is used by many researchers to model business processes. In future work, we may use the two standards: DFD and BPMN. In this work, we preferred to use activity diagrams to model the CIM of our digital marketing funnel (Funnel Type#2). We used simple transformations to move from the activity diagram to the uses case diagram. We believe that these two diagrams form the basis of our funnel's CIM. In the future, we can imagine modeling the other funnel types (Type#1 and Type#3) with their details and functionalities. In general, the lessons learned from this work at the corporate and academic level can be summarized as follows:

- The concepts and models that are developed are a project and a process at the same time. In addition, the process of understanding is linked to the knowledge project goal of our intervention: The funnel platform.
- We start from the assumption that the digital marketing system is an urgent necessity for several reasons stated above. This is related to a predetermined goal and conception related to the radical change imposed by the introduction of the advanced digitalization era and the recent economic crises.
- This platform (governed by our funnel model and CIM level of MDA) appeals to the planning, mission, vision and culture. It aligns the company's operational execution with the overall strategy. This platform makes marketing actions accountable and delivers effective value to customers. Marketing performance management activities will become systematic. This will have a significant impact on the availability, use and effectiveness of information for any business activity. The impact on decision making will be extremely intelligent as the Marketing Performance Management activity is assisted by this platform.

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