A Framework for Selection of Software-as-a-Service Products for Small and Medium Sized Enterprises

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Abstract

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Software-as-a-Service (SaaS), the most common form of cloud service deployment, provides the convenience of obtaining SaaS products from SaaS providers through a subscription or pay-as-you-go licence agreement. Thus, helps organizations to focus on their core business instead of support services such as IT infrastructure management, software maintenance etc. SaaS model, now offers SaaS products for Customer Relations Management (CRM), Enterprise Resource Planning (ERP), Human Resource Management (HRM), Accounting Management, Email Marketing etc. Thus, providing the best opportunity for Small and Medium Sized Enterprises (SMEs) to take advantage of the capabilities of CRM, ERP, HRM etc. systems on cloud, avoiding capital expenditure and management costs associated with the on-premise model. Hence, increasing number of SMEs are adopting SaaS products to leverage significant cost benefit without compromising on the quality of services (QoS).

However, business needs of every enterprise vary, so does their requirements for selection of the product. Several SaaS providers offers different types of SaaS products and the choice of a suitable SaaS product satisfying multiple criteria of the enterprise needs becomes a major issue. The multiple criteria involved in the decision making of SaaS product selection makes it a Multi-Criteria-Decision-Making (MCDM) problem. Thus, selection of SaaS product becomes a tiresome and time-consuming process.

Large organizations involve their IT experts and technical teams to take care of the complex software product selection decisions. However, SMEs are challenged with limited resources & expertise and had to rely on external consultants or vendors to get the recommendations of the software product(s) or service(s), satisfying the organizational needs. This consumes significant time & money. Sometimes the process of recommendation becomes costlier than the software adoption cost.

The research paper presents a standard procedure (Framework) for using AHP method to solve the MCDM problem and to help SMEs to choose a suitable SaaS product satisfying most of the criteria and alternatives. The procedure guarantees stakeholders participation, increases end user satisfaction and makes SaaS selection a quick, transparent process for the SMEs to adopt. SMEs could take advantage of the approach for the selection of SaaS product by means of prioritizing the product features and by expert-led ranking of the SaaS products.

Keywords: SaaS, SMEs, AHP, MCDM, CRM

Table of contents

1   Introduction

Software-as-a-Service (SaaS) is the most common form of cloud service model by which the software is deployed over the internet and delivered to thousands of customers. The software is hosted off-premise and the service is accessed using a web browser. Customer Relations Management (CRM), Enterprise Resource Planning (ERP), Human Resource Management (HRM) etc. systems are now offered on the cloud under the SaaS model. Thus, providing the best opportunity for Small and Medium Sized Enterprises (SMEs) to take advantage of the capabilities of CRM, ERP, HRM etc. systems on cloud, avoiding capital expenditure and management costs associated with the on-premise model (Seethamraju, 2015). Implementation failures, high initial and ongoing costs of on-premise ERP, CRM, HRM etc. systems make SMEs eager to obtain the opportunity to adopt the SaaS offerings.

SaaS provides cost benefits using economy of scale and helps organizations to avoid capital expenditure without compromising on the much-needed features like quality, availability, security, response-time, reliability etc. of the software in use. SaaS providers provides better, cheaper, more reliable services than on-premise services and ensures better services tailored to the current needs of the customer. SaaS helps organizations to focus on their core business instead of support services such as IT infrastructure management, software maintenance etc (Godse and Mulik, 2009). Hence, increasing number of organizations especially, SMEs are adopting SaaS for their software needs through a subscription or pay-as-you-go licence agreement avoiding initial expenditure.

Selecting a SaaS based offering from several SaaS providers providing SaaS based products becomes increasingly challenging as it requires a careful analysis of selection parameters and product offerings of the SaaS providers. The SaaS providers provide the same functionality as of others but differ in their quality of service (QoS) attributes. QoS refers to a collection of attributes of SaaS such as functionality, architecture, usability, scalability, suitability, response-time, throughput, latency, reliability, availability, security, reputation etc. which are crucial for the SaaS selection. Hence, selection of SaaS based products becomes a tiresome and time-consuming process to satisfy all the organizational needs.

This happens to be a MCDM problem as multiple criteria are involved in the decision-making process (Godse and Mulik, 2009). Hence, SMEs requires a standard procedure for a quick decision-making process for the selection of SaaS product. Enterprises can't rely on judgement or intuition of decision makers for this multi-criteria and multi-product SaaS selection problem. In general, during selection, the parameters are arranged or ranked according to their priority (Godse and Mulik, 2009). The prioritization occurs deciding the weights for

1

each of the parameters. While assigning judgemental weights, it's probable that user's judgement is centred on the principal parameters (Boussoualim and Aklouf, 2014). Thus, inappropriate weights are assigned to incorrect parameters which leads to inaccurate priority. Thus, judgemental decision-making makes subjective opinion and should be avoided. To make an informed decision we need to get a quantifiable value for the parameters to address the MCDM problem.

The research paper presents a standard procedure (Framework) by using AHP method to solve the MCDM problem and to help SMEs to choose a suitable SaaS product satisfying most of the conditions and alternatives. The procedure ensures quick, transparent, inclusive and no bias decision making to save time and cost involved in the decision making. AHP method is used to support group decision making. The AHP process construct an hierarchical model which has criteria weight and integrates different measures into a single overall score for ranking decision alternatives. SMEs could take advantage of the standard procedure based on AHP method for the selection of SaaS products by means of prioritizing the product features and ranking of the SaaS products.

2　Background of Research

Small and Medium Sized Enterprises (SMEs) lacks decision making capabilities due to lack of resources and expertise. The resources capable of taking decisions are often pre-occupied with activities more important for the core business of the organization. Hence, SMEs delegate the non-core decisions to external consultants or vendors to get the recommendations of the software products satisfying the organizational needs. The consultants or vendors not fully aware of the business requirements takes time to understand the requirement of the enterprise's business. Thus, selection of products consumes more time and money and sometimes becomes costlier than the software product adoption cost. Moreover, the traditional way of product selection poses a significant risk specially for the SMEs to gain competitive edge in the business.

SaaS decision-making process initiated by the consultants are often biased to certain SaaS product offering. Enterprises keeps the stakeholders out of the selection process to gain the time consumed by the consultant. Thus, selection of SaaS product becomes an ambiguous decision-making process taken in silos and result in dissatisfaction among the end user of the product.

Moreover, Customer Relations Management (CRM), Enterprise Resource Planning (ERP), Human Resource Management (HRM), Accounting Management, Email Marketing etc. are now available in cloud as SaaS model. SMEs using on-premise CRM, ERP, HRM etc. wants to take advantages of this huge SaaS offerings to avoid capital expenditure and management costs associated with the on-premise model and remain competitive in business.

With more and more SMEs adopting SaaS products to leverage the significant cost benefit of SaaS model offerings without compromising on the quality of services (QoS), SMEs feel the need of a standard selection procedure for selecting and ranking SaaS offerings quickly and reliably maintaining their business requirements. Wrong selection of SaaS products has an immediate adverse impact on the business of the SMEs. Hence, SMEs wants to ensure they select the most appropriate SaaS product for their needs.

Hence, the objective of the research is to develop a standard procedure (Framework) for selection of SaaS product which ensures transparent, inclusive and no-bias decision-making involving all the stake holders of the organization. The procedure should allow a careful analysis of selection parameters of different SaaS product offering, to enable a reliably solution to the MCDM problem involved in the decision-making process. The

procedure should ensure end user satisfaction and reduce time, money and complexity of the SaaS selection process.

To achieve the research objectives, one need to understand the available MCDM methods in order to choose an appropriate method for the standard procedure for selection of SaaS products. Several methods are available to solve the MCDM problem such as the linear weighting methods, Analytic Network Process (ANP), Data Envelopment Analysis (DEA), Fuzzy Set Theory (FST), Genetic Algorithm (GA), Artificial Neural Network (ANN) and Mathematical Programming Techniques (MPT). The linear programming methods are simple to implement but they are not accurate, and more variations exist (Nallusamy et al., 2016). Therefore, literature review of the latest MCDM tools such as Analytical Hierarchy Process (AHP), Fuzzy Logic (FL) and Artificial Neural Network (ANN) had been done.

Fuzzy Logic Decision Making Method (FLDMM): The decision making happens by choosing a suitable alternative from those that are needed for realizing a certain goal. The prime domain for existing fuzzy decision-making is uncertainty (Nallusamy et al., 2016). The decision making happens in steps – A) Determining the Set of Alternatives − the step determines the alternatives from which the decision must be taken. B) Evaluating Alternative − here the alternatives must be evaluated so that the decision can be taken about one of the alternatives. C) Comparison between Alternatives − a comparison between the evaluated alternatives are done. There might be situations in FLDMM where the decision-making is excellent, but the outcome may be adverse. Advantages using the method may prevail if good decisions are made continuously for a longer period time.

Analytic Hierarchy Process (AHP): AHP developed by Thomas L Satty is a technique for individual and group decision making. AHP breaks down the MCDM problem into its smaller constituent parts forming hierarchy, then calls for only simple pair-wise comparison judgments thus forming the comparison matrix to judge the weight. Developing a hierarchy allows focusing judgment separately on each of the several properties essential for making a good decision. AHP is flexible, deals with intuitive, rational and/or irrational, multi-objective, MCDM with certainty and/or uncertainty for any number of alternatives and checks inconsistencies. (Godse and Mulik, 2009). Constructed hierarchal structure of AHP makes the importance of each element clear, enabling no bias decision making. Increased number of pairwise comparison decreases the chances in irregularities in ranking.

Artificial neural networks (ANN): An artificial neural network is an information processing system that has certain performance characteristics in common with biological neural networks. ANN is a special type of method such that it has a special learning feature and

4

weights are calculated by assumption. It does not need the help of an expert or a fuzzy integration method (Nallusamy et al., 2016).

Depending upon the literature review, we find significant benefits of using AHP methods compared to other methods in SaaS product selection aligning with the research objectives. One of the main objectives of selection of SaaS product is ensuring organizational or stakeholders' participation in decision making. AHP supports group decision making. Hierarchical structure of the criteria (factor) and sub-criteria (attributes) of the SaaS product features provides much-needed visibility to the decision makers. AHP makes the importance of each element clear, enabling no bias decision making. Increased number of pairwise comparison in AHP decreases the chances in irregularities in ranking. AHP method provides the clarity in the selection process over other methods which the decision makers want and can rely on. Hence, AHP method is chosen for SaaS product selection over other MCDM methods of linear weighting methods, FLDMM, ANN etc.

3 Objectives and Scope

3.1 Research Objectives

The objective of the research is to develop a SaaS selection procedure (Framework) for selection and ranking of SaaS offerings suitable for the SMEs' organizational and business needs involving all the stakeholders of the organization. The SaaS selection procedure should ensure

a. **Research Objective 1**: Transparent, inclusive and no-bias decision-making for SaaS product selection involving all the stake holders of the organization considering business needs and end user satisfaction.

b. **Research Objective 2**: Reduction of time, complexity and money in the SaaS selection process for SMEs.

c. **Research Objective 3**: Provide a comparative ranking of SaaS products in consideration to choose from.

The above three (3) Research Objectives are the immediate objectives of the research. The below two (2) Research Objectives are in lines with the thesis objectives though will not be covered in detail.

d. **Research Objective 4**: Design a mobile application and store the data in databases for future reference.

e. **Research Objective 5**: Continuous feedback from stakeholders even after the SaaS selection process.

3.2 Research Scope

The Research Objectives of the research is quite generic in nature. Hence, this need to be scoped carefully enough to be able to accommodate the research in the master thesis. Hence, it has been narrowed down with the following scopes.

a. **Scope 1**: The target organizations of the thesis are the Small & Medium Sized Enterprises.

b. **Scope 2**: The procedure (Framework) for selection of SaaS products is limited to one category SaaS products. Hence, the case study will focus on SaaS CRMs suitable for SMEs.

c. **Scope 3**: The thesis will emphasize more to solve the MCDM problem using AHP method by prioritizing the product features and with expert-led ranking of the SaaS products.

d. **Scope 4**: Limited emphasis on SaaS selection procedure (Framework) and corresponding mobile application design as it needs more iterations with different category of SaaS offerings suitable for SMEs.

3.3   Research Questions:

Following are the research questions prepared for the structured and semi-structured face-to-face interviews.

RQ1: What are factors that influence and challenges the selection of SaaS Product(s) in an SME organization?

RQ2: What attributes in your opinion the SaaS Product should possess to be selected for an SME organization.

RQ3: Do you think SaaS Product selection guideline will reduce time and cost of decision making and is required for the SMEs?

RQ4: How will you measure the success of SaaS selection guideline? How will you ensure new SaaS product increase customer satisfaction?

The research questions mentioned will help the research in collecting the data from the SMEs.

4 Business Context

The business context of the thesis is related to process improvements of SMEs, for taking quick and business aware decisions regarding smooth SaaS product selection. Improved SaaS product selection process should give SMEs the business benefit, competitive edge, reduced time & money and enhanced customer experience. The improvement can be measured by calculating reduced cost, reduction of time for business decision, increase in productivity, less time to market and the decrease in customer reported incidents and increases customer satisfaction.

4.1 Business Benefits

SaaS product selection framework for SaaS products will have the following benefits:

Competitive Edge: Selecting desired SaaS product satisfying all the business needs of the SME using the SaaS selection procedure will provide the SME with competitive edge in business.

Quick Decision Making: SaaS Product Selection method will provide a comparative ranking of products with facts and analysis. This will enable quick and transparent decision-making for the selection of the SaaS products as per the business needs.

Smooth Adoption: Product selection framework will provide technology understanding and preparedness required for adoption of the selected product.

Ranking of Products: It will provide comparative ranking of SaaS products by categories to choose from.

Customer Satisfaction: User satisfaction is considered prime for the SaaS selection. Capturing the end user's opinion in decision making process will ensure customer satisfaction & reduction in incidents reported and continuous feedback will ensure continuous improvement.

Reduction of Operational Cost: SaaS offers CRM, HRM, ERP products which otherwise are only available on-premise. Thus, eliminates the initial and ongoing cost of on-premise applications.

Adoption Plan: The framework roughly defines the duration of the SaaS selection process to complete. Thus, enables planning of adoption needs e.g. training, documentation etc. for end user.

Avoiding Expensive Mistake: Choosing the wrong SaaS product can be an expensive mistake and it can waste valuable time and money for the organization. The framework ensures the SaaS selection does justice to the organizational needs, time and money.

4.2 Stakeholders

The stakeholders are broadly categorized as Decision maker – Non-IT, Decision Maker – IT, IT Experts and End User which consists of different roles in the organization. The stakeholder matrix for the decision-making process are as follows:

TABLE 1: STAKEHOLDER MATRIX

SL No.	Organizational Role	Stakeholder Category
1	HR Manager	Decision Maker – Non - IT
2	Corporate Manager	
3	Finance Manager	
4	Sales Manager	
5	Project Manager	Decision Maker - IT
6	Technical Manager	
7	Product Owner	
8	Program Manager	
9	Product Specialist	IT Expert
10	Developer	
11	Tester	
12	Administrator	
13	Organizational Employee	End User
14	Third Party User	
15	Student	
16	Teacher	

4.3 Business Model Canvas

Business Model Canvas (BMC) is a strategic management and lean startup template for developing new or documenting existing business models ('Business Model Canvas', 2020). BMC used to understand how the process improvements could be done to help the SMEs, take quick, transparent and inclusive SaaS product selection decisions involving all the stakeholders. The canvas will help to gain insights about the resource needs, what value propositions are offered using what channels, how the process improvement could be done and how customer relationship works. BMC model clarifies and documents the process improvement by segment. Analysis using BMC by segment helps the research to create the research methodology to ensure research create, delivers and captures those values.

Key Activities -

- Study of SaaS product features and attributes

- Extract information of SaaS products from SaaS providers websites.

- Derive the factors and attributes of selection of SaaS products per SaaS product category.

- Conduct SaaS product selection survey.

- Analyze and rank the SaaS products using AHP method.

- Collaboration between stakeholder for decision making.

Key Resources -

- Webpages of SaaS products.

- Tutorials, videos, code examples, GitHub repositories etc.

- Survey and collaborative tools.

- Stakeholders – Decision Maker, Decision Maker-IT, IT Experts and End Users.

Value propositions -

- Quick, transparent, no-bias and inclusive decision-making based on facts and findings.

- Reduced time & money involved in decision making.

- Ranking of SaaS products.

- Competitive edge.

- End user satisfaction, Enterprise satisfaction and less incidents.

Channels

- Websites

- Social Media

- Mobile Application

Customer Relationship

- End User Satisfaction - in using SaaS products

- Stakeholder's participation in decision making

- Self Service – Mobile Application for Stakeholders

- Collaborative channel – Continuous Feedback

Customer Segment

- Small and Medium Sized Enterprises.

5 SaaS Product Selection Parameters

Many factors and criteria are involved in the selection of a SaaS product, as it is a MCDM problem. The main challenge of the MCDM problem is that, comparison of attributes become immensely difficult among the SaaS software product services as they provide same functionality but differs in their quality of service (QoS) with interdependent relationship. The AHP is used to solve the MCDM problem of selection by ranking the SaaS software product services with matching characteristics.

Based on the literature study, experience and survey with the industry experts, decision makers and end users, I am proposing the factors for SaaS selection. The factors are: Functionality, Architecture, Usability, Vendor Reputation and Cost. These factors are selected primarily considering our case study of SaaS CRM offerings of Sales Force CRM, Zoho CRM and HubSpot CRM.

These factors are generic in nature and the chosen factors are supported by the literate studied. Experience and Survey results also complemented the factors selection for any SaaS software product selection. However, the factors may change depending on the category of SaaS offerings and priorities of the SME.

Selection of attributes under the factors are a difficult choice and every organization has their own priorities. However, the attributes under the functionality factor changes depending upon the category of SaaS product for selection. The top attributes which affects the factors significantly are selected for the AHP method. The choice of an attribute under any factor or changing the attributes to another factor has effect in selection of SaaS products, however the effect is much greater in selection process if the decision comes to whether or not to onboard the attribute for selection. AHP method does the pairwise comparison of criteria with respect another. Hence, the error introduced for the incorrect attribute selection average outs. The research provides a base by suggesting general factors and attributes for SaaS CRM selection and recommend the involvement of organizational stakeholders and product specialist in selection of attributes and factors as the exercise is crucial for the success of the SaaS selection process.

The following section discussed about the factors and attributes affect the selection of SaaS CRM selection of Sales Force CRM, HubSpot CRM and Zoho CRM.

5.1 Functionality:

Functionality (F1) factors include attributes that are typically called as functional modules of SaaS CRM offerings (Shrikant Mulik, 2009). The functional modules of Sales Force CRM, Zoho CRM and HubSpot CRM are:

A) **Sales Force Automation** (F11) ensures storing and retrieving information associated to customer contact and account (*Contact & Account Management),* manage partners by tracking channel partner leads and sales opportunities (*Partner Relationship Mgmt. (PRM)),* manages sales opportunities through their life cycle from lead to order (*Opportunity & Pipeline Management),* manages and tracks tasks and activities (*Task / Activity Management),* assign and manage sales quotas and territories (*Territory & Quota Management),* allows user to sync their Emails, Calendar and Contact tools with their CRM System (*Desktop Integration),* ensures entering product and part numbers and managing their prices associated with them (*Product & Price List Management),* allowing users to create a quota to be provided to a customer that contain at least products, prices and associated discounts (*Quote & Order Management)* and for management of contracts made with customers (*Customer Contract Management).*

B) **Marketing Automation** (F12) helps user to send email to contacts in bulk *(Email Marketing),* optimizes the process for organizations to develop and deploy the marketing campaigns using multi-channel to target groups or individuals (*Campaign Management),* allows users to manage and track leads through a process (*Lead Management),* and enables analysis of effectiveness of an organization's various marketing activities *(Marketing ROI Analytics).*

C) **Customer Support** (F13) tracks issues reported by customers through the resolution process (*Case Management),* provides a convenient way to answer customer queries, post service issues, place orders, view order history and gain access to information contained in knowledge base (*Customer Support Portal),* provides means to collect, organize, share, search and utilize information in knowledge base *(Knowledge Base),* allows customer support professional to access all the relevant information to support the customer *(Call Center Features),* helps analysis of customer support activities to optimize customer support professionals, processes and tools *(Support Analytics).*

D) **Reporting & Analytics** (F14) offers an easy to read single page, real time user interface with graphic representation showing current status and historical data of companies KPIs (Key Performance indicator) *(Dashboards)*, enables reporting all the data contains in the repository *(Reporting)*, enable forecasting of sales and revenue depending upon historical sales data, analysis of market trends and surveys *(Forecasting).*

E) **Mobile & Social Media** (F15) focuses on identification of groups and collaboration spaces where massages are explicitly directed at the group to be seen by everyone on group thus enabling multiple users to interact by sharing information to achieve a common goal. (*Social Collaboration Features),* uses social networks to listen and engage with the customers *(Social Network Integration)***,** enables the software offering to be easily used of multiple mobile devices including mobile and tablet devices *(Mobile User Support).*

F) **Platform** (F16) provides the facility to administrators to customize their unique process by creating custom objects, fields, rules, calculations **and** views (Customization), enables automated process which requires series of steps operated by several different users *(Workflow Capability),* enables user to view and interact businesses with same content in multiple languages and currencies *(Internationalization)*, allows administrator to easily develop and test changes to the CRM deployment *(Sandbox / test Environments)*, enables content management for CRM system which includes presentations, documents, images and other related electronic files (*Document & Content Mgmt),* allows administrator to create template that enables user to quickly generate dynamic documents in various formats based on the data stored in the application (*Output Document Generation).*

5.2 Architecture:

The architecture (F2) factors for the consideration of a SaaS selection are generic in nature which are as follows:

A) **Integration** (F21) attribute considers the ability of the product to integrate with the other application or product. Integration attribute offer ability to input, modify and extract data from application in bulk through structured files (*Data Import & Export Tools),* the specification for how the application communicates with other applications using application program interface *(API Integration)* and how readily the partner applications are available for integration and to what *extends (Integration to Partner Application)*. The integration attributes for SaaS products are very important as they host in cloud and need to be integrated with other on-premise applications and specially with legacy application which perceived to be quite difficult.

B) **Scalability** (F22) refers to as the SaaS product's ability to handle the growing amount of work with stable performance maintaining reasonable response time for the user even during the peak load by provisioning new resources.

C) **Reliability** (F23) refers to the SaaS product's ability to perform reliably which mean to remain consistently available (uptime) and to allow users to complete tasks quickly and not waiting for the application to respond to an action they took. SaaS product vendor should

have the required monitoring and diagnostic tools to ensure that the SaaS product adheres with the reliability & performance metrics.

D) **Security** (F24) is one of the major concerns for the SaaS product selection for any organization. SaaS vendor should have the required certification of the SaaS product like GDPR, ISO Certifications which helps ensure security adopted for handling of customer data. SaaS application should have the required security feature of access management and security compliance required. Application security should ensure granting of access to selected data, features, objects etc. based on the users, user role, groups etc.

E) **Suitability** (F25) of choosing a SaaS product for an organization depends on the business and business model of the organization. The suitability attribute is a combination of attributes like immediate cost saving, flexibility and ease of implementation which are primarily considered between the choices in hand.

5.3   Usability

The usability (F3) attributes are as follows:

A) **Ease of Use** (F31) refer to facets such as ease of use for frequently required tasks, ease of setup of environment such as reports, custom dashboard etc., ease of administering the SaaS product, the quality of support (knowledge base) with the organization and most importantly the ease of doing the business & meeting the requirement of the business with the SaaS offering. Offline Support is also an important attribute for ease-of-use as it allows user to work on the SaaS product in offline mode and let them synchronize once connected to the internet.

B) **Language Support** (F32) is the refer to as the supported language options the SaaS product offer for the customers to use. This is mostly essentials to know for the SMEs as they generally prefer to have the SaaS product to be operated in their regional language.

C) **Training** (F33) attribute refer to the help available in the form of easy-to-use user manuals, training videos, E-learning modules, online documentation, webinars and context sensitive help.

D) **Supported Platform** (F34) basically refers to the platforms the SaaS offering is available for use. The option includes web vs installed in different operating systems (Cloud, Windows, Mac, Linux) and on Mobile in different OS (Android /iOS) etc. Support for mobile devices has become importance as modern sales workforce extensively use mobile devices.

E) **Support** (F35) refers to the support different offering of the SaaS product vendor online chat option, 24/7 live chat, Business hour support, Email & telephonic support and ticketing service.

5.4 Vendor Reputation:

Vendor reputation (F4) factor include the following five attributes:

A) **Number of Clients** (F41) indicates the level of use of the product. This indicates the segment of the product weather be it new entry or a well-established product. The bigger the reputation of client like no. of fortune 500 clients the more weight it gets to be selected.

B) **Quality Compliance** (F42) of the vendor ensure vendor credibility. Certifications such as ISO 27000, GDPR compliance helps ensure quality compliance adopted for handling of the customer data.

C) **Brand Value** (F43) is the most important as a new product from a well-known vendor may be prefer over a product with large customer base but from a not so well-known vendor.

D) **User Satisfaction** (F44) of the user of the product is considered to one of the most important attributes to be considered for the selection. The user satisfaction reports from various surveys provides a clear picture of the products pros and cons alongside user experiences of using the product.

E) **Data Security** (F45) attribute is a considered one of the key considerations of choosing an on-premise offering or in-house offering over SaaS product offering. Data storage, data security, data migration, data traffic and data location need to be carefully discussed and understand before the selection of any SaaS offerings. Quality compliance certifications ensures data security.

5.5 Cost

Cost (F5) factor includes three attributes: A) **Free** (F51), B) **Annual / Monthly subscription cost** (F52) and C) **One-time payment** (F53). Free SaaS offering are available alongside with annual and monthly subscription cost. Free SaaS offering are restricted with limited use of features. Usually full support and features of SaaS offerings comes with a monthly or annual subscription cost which varies from product to product. Initial consulting, configuration efforts etc. is covered under the one-time cost generally incurs as an implementational cost.

6   Analytic Hierarchy Process (AHP)

The AHP developed by Thomas L. Satty, provides a structured technique for analysis and organizing complex decision making based on mathematics and psychology (Analytic Hierarchy Process, 2020). The AHP approach more extensively used in a MCDM problem in which multiple criteria are involved in decision-making. The AHP is suitable for a wide verity of decisions involves human judgmental process (Lee et al., 2001) and helps either a decision group or a single decision maker to solve a MCDM problem. The AHP process construct an evaluation model which has criteria weight and integrates different measures into a single overall score for ranking decision alternatives.

Applying the AHP procedure to solve a MCDM problem involves three basic steps (Ching-Fu Chen, 2006):
1. Decomposition – The hierarchical construction.
2. Comparative Judgement – Defining and executing data collection to obtain pairwise comparison data on elements of the hierarchical structure.
3. Synthesis of Priorities - Constructing an overall priority rating.

6.1   Decomposition

Decomposition into a hierarchal structure happens based on the literature study and emphatical experiences. The hierarchical construct typically forms with Top Level (Goal)–objective from management standpoint, Immediate Level – criteria (Factors) and sub-criteria (Attributes) that subsequent level depends on and Lowest Level – List of alternatives. In AHP it is important that all the essential elements relevant to problem are covered within the hierarchical structure (Ching-Fu Chen, 2006).

The SaaS product selection parameters, The criteria (Factors) and sub-criteria (Attributes) has been decided based on literature study & experiences captured with interviews and survey questionnaire from the decision makers for the goal of SaaS product selection for SMEs.

6.2   Comparative Judgement

Succeeding development of hierarchical structure data collection happens with pairwise comparisons to determine the relative importance of the elements in each level of hierarchical structure. Decision makers begins the prioritization procedure, evaluate the criteria, sub-criteria and each alternatives on each criteria by rating them equally important or differently in a scale of 1 to 9 at each level of the hierarchy (refer Table 2) by asking questions like How important is Cost compared to Functionality? or visa-versa.

The case study for the SaaS CRM selection for SMEs evaluates the criteria, sub-criteria and the list of alternatives against each criteria in a scale of 1 to 9. The decision makers participates in the survey and provide their judgement of the pairwise comparison of relative important of the factors and attributes.

TABLE 2

9-POINT INTENSITY OF RELATIVE IMPORTANCE SCALE

Intensity of Relative Importance	Definition	Explanation
1	Equal importance	Two activities contribute equally to objective 1.
3	Moderate importance of one over another.	Experience and judgment slightly favor one activity over another.
5	Essential or strong importance	Experience and judgment strongly favor one activity over another.
7	Demonstrated importance	An activity is strongly favored, and its dominance is demonstrated in practice.
9	Extreme importance	The evidence favoring one activity over another is of the highest possible order of affirmation.
2, 4, 6, 8 Reciprocals of the above nonzero numbers	Intermediate values between the two adjacent judgments. Reciprocal for inverse comparison	When a compromise is needed.

Source: Adapted from Satty and Kearns (1985)

6.3   Synthesis of Priorities

Upon collecting the data, AHP provides an analytical process to combine and consolidate the evaluations of the alternatives and criteria by either an individual or group involved in the decision-making task (Crouch and Ritchie, 2005). Thus, comparison of two elements at a given time greatly reduce the conceptual complexity of the analysis (Ching-Fu Chen, 2006). Given a pairwise comparison, the analysis involves in three tasks:

a) Developing a comparison matrix at each level of the hierarchy starting from the level -1 and working down,

b) Computing the relative weights for each element of the hierarchy, and

c) Estimating the consistency ratio to check the consistency of judgment (Ching-Fu Chen, 2006).

Starting from the top of the hierarchy and working down, in each level of the hierarchical structure the elements are compared in pair with respect to their importance to an element in the next higher level. The pair-wise comparison at a given level can be represented as a number of square matrices $A = [a_{ij}]_{nxn}$, as in following

$$
\begin{pmatrix}
a_{11} a_{12} \cdots a_{1n} \\
a_{21} a_{22} \ldots a_{2n} \\
\ldots \ldots \ldots \ldots \ldots \ldots \\
a_{n_1} a_{n_2} \ldots a_{nn}
\end{pmatrix}
$$

The reciprocal properties of the matrix are

$$
a_{ji} = \frac{1}{a_{ij}}
$$

The AHP recommends a scale from 1 to 9 of relative importance for making subjective pairwise comparisons (see Table 2). After forming all pairwise comparison matrices, the vector of weights, $w = [w_1, w_2, ..., w_n]$ is computed. Thomas L. Satty recommended eigenvector procedure the basis for the calculation of the vector of weights. The computation of the weights involves two steps. First, the pairwise comparison matrix $A = [a_{ij}]_{nxn}$ is normalized by equation (1), and then the weights are computed by equation (2) (Ching-Fu Chen, 2006).

Normalization:

$$
a^*_{ij} = \frac{a_{ij}}{\sum_{i=1}^{n} a_{ij}}
$$

(1)

for all j = 1,2, 3, .. , n

Weight Calculation:

$$
w_i = \frac{\sum_{j=1}^{n} a^*_{ij}}{n} \tag{2}
$$

for all i = 1,2, 3, .. , n

The vector weights are also called 'Criteria Weights. The criteria weight of the factors (Level –1) (refer Figure: 10) in the case study is called as 'Global Weight' and the criteria weight of the attributes (Level –2) in the case study is called as 'Local Weight'.

18

Equation (3) shows the relationship between the vector weight w and the pairwise comparison matrix.

$$Aw = \lambda_{max}w \tag{3}$$

The validating parameter. λ_{max} is used as a reference index for calculating the Consistency Ratio (CR) of the estimated vector. The Consistency Index (CI) for each matrix of order n which can be obtained from equation (4) is required to calculate the consistency ration (CR).

$$CI = \frac{\lambda_{max}-n}{n-1} \tag{4}$$

After obtaining consistency index (CI) consistency ration (CR) can be calculated using equation (5)

$$CR = \frac{CI}{RI} \tag{5}$$

where RI = Random Consistency Index. This is obtained from a randomly generated pairwise comparison matrix. The value of RI from matrices of order of 1 to 10 is shown in Table 3.

TABLE 3

RANDOM INCONSISTENCY INDICES (RI) FOR N = 10

N	1	2	3	4	5	6	7	8	9	10
RI	0.0	0.0	0.58	0.9	1.12	1.24	1.32	1.41	1.46	1.49

The comparison is acceptable if CR < 0.1. If CR � 0.1, then the value indicates inconsistent judgements and then one should reconsider and revise the original values in the pairwise comparison matrix A.

The aggregate measures of the pairwise comparison matrix becomes relevant for group participation in decision making. To obtain the aggregate of the pairwise comparison matrix, the geometric mean of the individual assessments can be used as follows:

$$a_{ij}^{hp} = \sqrt[Q]{\prod_{q=1}^{Q} a_{ij}^{q}} \tag{6}$$

where a_{ij}^{q} is an element of matrix A of an individual q (q = 1,2,3, …, q) & a_{ij}^{hp} is the geometric mean of all the individual a_{ij}^{q} and the group CR is calculated based on equation (4) and (5)

7   Research Methodology

Progressive problem solving with action research strategy has been chosen as the methodology for the SaaS product selection work activities. This is an iterative approach which contain several cycles (cycle 1, cycle 2, .. , cycle n) to reach the objective. The strategy starts with the study and planning of the research. The next step describes the tasks for the data collection. Data collection and analysis of the collected data happen in the third step. The outcome reflects the how the objectives of the research been met (refer, Figure 1).

FIGURE 1

PROGRESSIVE PROBLEM SOLVING AND ACTION RESEARCH

Progressive Problem Solving with Action Research
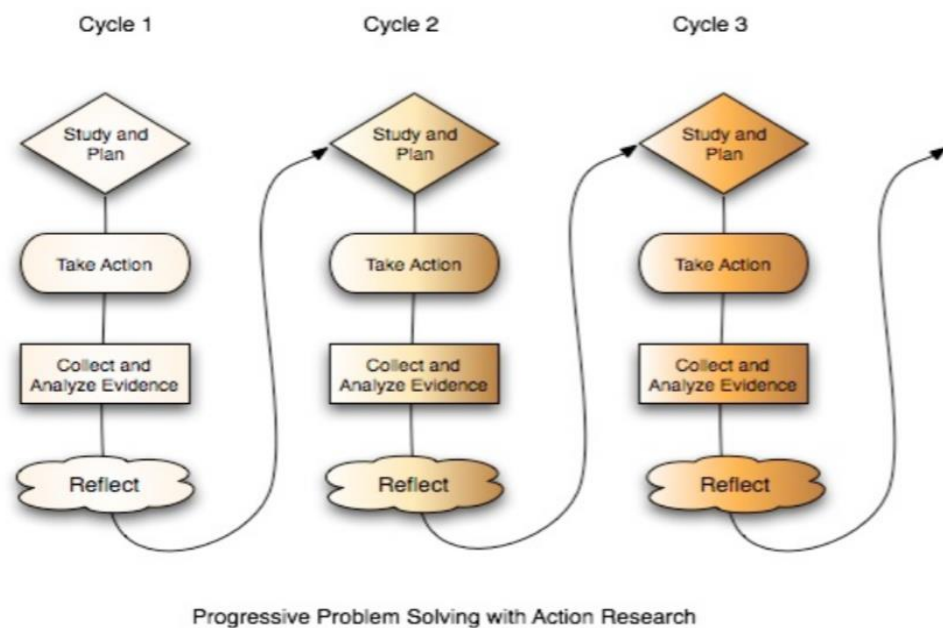
The Business Model Canvas (BMC) discussed in section 4.3 documents the business model of the process improvement needed for the SMEs. The documentation by building blocks in BMC helps to create the research methodology steps for SaaS selection, combining it with the progressive problem solving with action research strategy (refer, Figure 1). Thus, analysis of business model by building blocks using BMC is important and it provides the template for the research methodology and helps choose the implementation strategy to combined with.

The methodology adopted starts with the literature study to understand the parameters satisfying the application requirements. The websites of SaaS CRMs used in the case study has been referenced to gain understanding of parameters. These parameters are discussed with the experts in the next phase and, hierarchy is developed. The survey instruments of AHP are developed from this hierarchy. Two types of AHP survey instruments are

developed for pairwise comparison. One is for comparison of parameters and the other for products comparison. The pair of comparison is judged on 1-9 scale. The survey respondents are only experts; hence, number of responses were limited. The mandatory requirement for expert is to have experience in using the SaaS products before responding the survey. Three-part case study is adopted for the SaaS CRM product selection. The first part covers the prioritization of parameters while second part is about product comparison. The third part combines the results obtained from first two parts to rank the products. The outcome of the methodology comes in the form of defining the architecture and workflow procedure for the SaaS selection Framework. Another outcome is the in-line research objective of designing a mobile application for future use. (refer Appendix).

FIGURE 2

SAAS SELECTION METHODOLOGY- SAAS CRM SELECTION
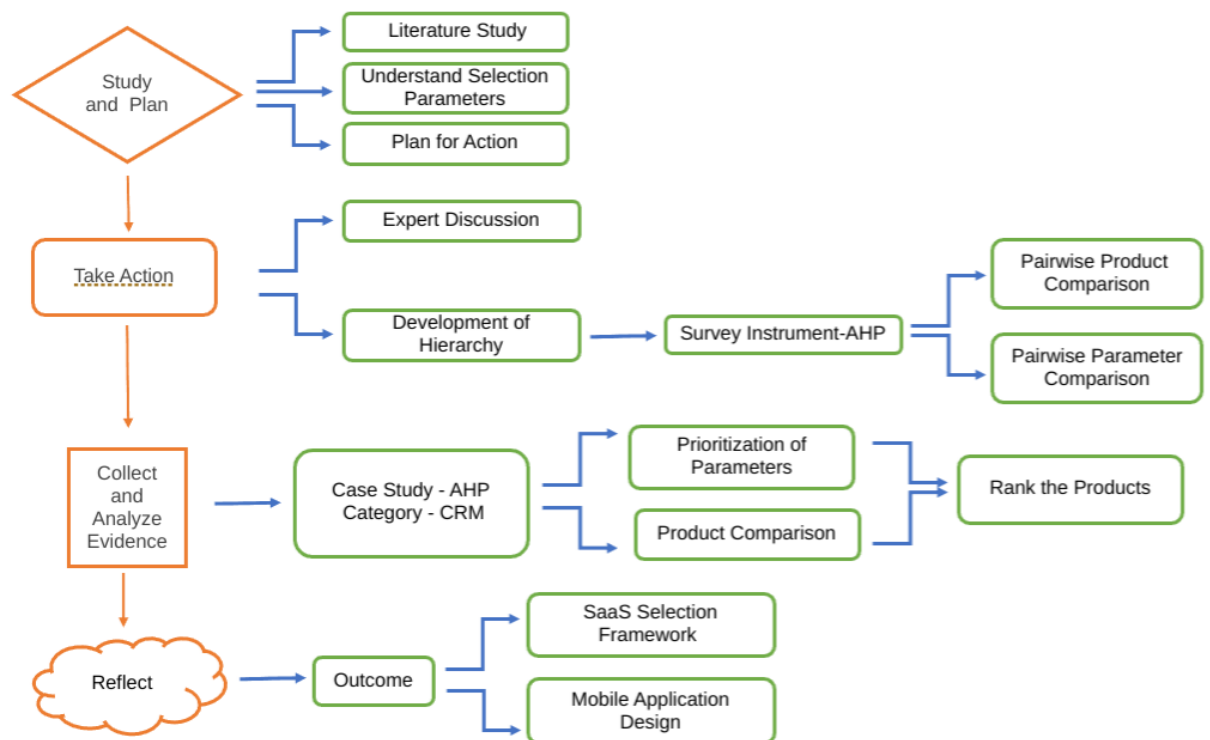
The 1st iteration of the research methodology cycle 1, focuses on the case study. The case study help develop a standard SaaS selection procedure for SaaS Customer Relationship Management (CRM) and ranks the selected SaaS CRM products using AHP. Thus, through the implementation of SaaS CRM case study, the architecture and workflow procedure for the SaaS selection Framework are derived. The Case Study uses the most used SaaS CRMs Sales Force CRM, ZOHO CRM and HubSpot CRM. The consecutive cycles will focus on other categories of SaaS products such as ERP, HRM etc to full proof the SaaS product selection methodology.

8   Data Collection and Data Analysis

There are two types of data collection methods used during the research. a) Primary data collection and b) Secondary data collection.

The primary data consists of the information collected from the respondents in the form of formal interviews (Structured and Semi-Structured) and questionnaires (Surveys). Questionnaires are a written list of questions which is distributed to participants in order to record their answers. In a questionnaire respondent read the questions, interpret what is expected and then write down the answers.

Secondary data collection can be defined as those data that have been collected from the websites. Secondary data includes both raw data and published summaries of the product. For the purpose of Case Study secondary data had been collected for Zoho CRM, Sales Force CRM and HubSpot CRM from their respective websites.

8.1   Data Collection

Following are the research questions prepared for the structured and semi-structured face-to-face interviews.

RQ1: What are factors that influence and challenges the selection of SaaS Product(s) in an SME organization?

RQ2: What attributes in your opinion the SaaS Product should possess to be selected for an SME organization.

RQ3: Do you think SaaS Product selection guideline will reduce time and cost of decision making and is required for the SMEs?

RQ4: How will you measure the success of SaaS selection guideline? How will you ensure new SaaS product increase customer satisfaction?

Only one IT expert had been interviewed from curity.io using the above research questions. To increase the participation and data collection, surveys had been used for the research. In survey questionnaire method, the respondents are asked to choose from a set of answers. All the participants are asked the same questions, in the same order and using the same wording and having the same set of answers to choose from.

The research survey consists of three parts – a) SaaS selection Questionnaire, b) Analytical Hierarchy Process Questionnaire and c) Case Study Questionnaire. For the SaaS selection Questionnaire, several questions were asked to obtain information about the prospective respondent such as job category, job position, organizational type, SaaS knowledge, SaaS selection etc. A five-point Likert scale ranged from strongly disagree to strongly agree was adopted to measure the need of SaaS product selection framework for

the SMEs. For Analytical Hierarchy Process Questionnaire questions were asked to obtain information about relative importance of the factors and attributes of selection for pairwise comparison. The scale ranged from extremely 9, to equally 1 for A options and from equally 1 to extremely 9 for B options. The example Q&A for this section is as follows:

For Case Study Questionnaire similar questions to AHP Questionnaire were asked to perform pairwise comparison of factors and attributes corresponding to the SaaS products of Sales Force CRM, Zoho CRM and HubSpot CRM. The similar scale of extremely 9, to equally 1 for A options and from equally 1 to extremely 9 for B options were used to get the participants opinion on product selection for pairwise comparison of attributes. The research survey contained 7 survey questions on SaaS selection Questionnaire section, 1 survey question & 63 pairwise comparison questions on Analytical Hierarchy Process Questionnaire section and 72 pairwise comparison questions on Case Study Questionnaire section.

The survey used sogosurvey.com a SaaS product offering to conduct the survey free of cost. After the questionnaire was finalized, the survey was distributed online via email and via professional tool LinkedIn to about 50 professionals in Finland working as decision maker, IT expert and end user in various organizations specially in SMEs. 3 IT experts were sent additional information about the alternatives namely Zoho CRM, Sales Force CRM and HubSpot CRM to facilitate their participation.13 participants responded to the invitation to participate and out of which 11 participants successfully completed the survey. The following table describes the job description and category of the survey participants.

TABLE 4

DESCRIPTIONS OF THE SURVEY PARTICIPANTS

SL No.	Job description	Category
1	Administrator	IT Expert
2	Marketing Manager	Decision Maker – Non-IT
3	SW Development Director	Decision Maker – Non-IT
4	Project Manager	Decision Maker - IT
5	Project Manager	Decision Maker - IT
6	End User	Student
7	Administrator	IT Expert
8	Finance Manager	Decision Maker - Non-IT
9	Developer	IT Expert
10	Not Specified	IT Expert
11	Corporate Manager	Decision Maker - Non-IT

8.2 Data Analysis

There were Four (4) IT Expert, Six (6) Decision Maker out of which Four (4) Non-IT Decision Maker and Two (2) IT Decision Maker and One (1) student participated in the interview.

FIGURE 3

SURVEY ANALYSIS: PARTICIPANTS ORGANIZATIONAL ROLE

What role do you prefer to be in while conducting the Survey ?
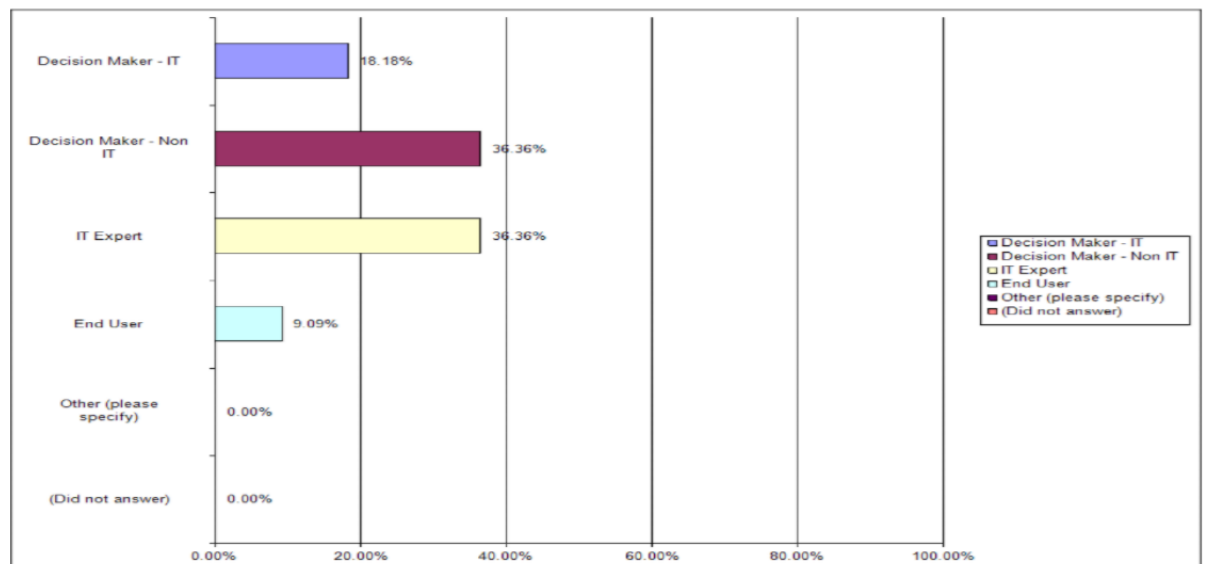
Analyzing the survey data following are the major findings:

A) The need for SaaS product selection Framework - Strongly Agree (9.09 %), Agree (36.36 %), Neutral (27.27%).

FIGURE 4

SURVEY ANALYSIS: NEED OF SAAS PRODUCT SELECTION FRAMEWORK

Do you feel the need of a Framework for Software-as-a-Service (SaaS) Product Selection and Provisioning?
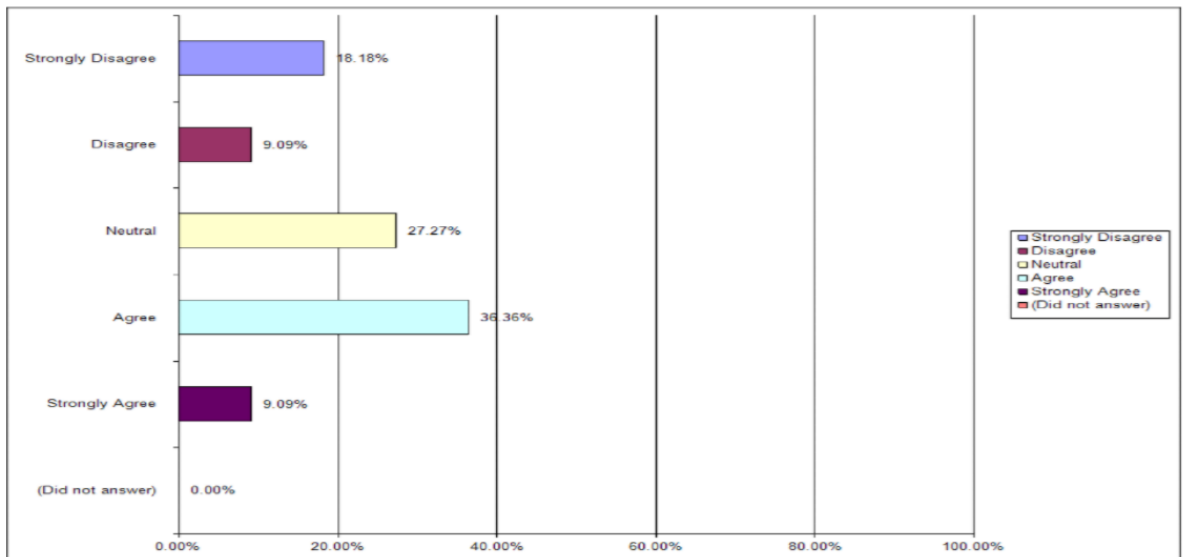
B) The top benefits the SaaS product selection Framework could bring to the SMEs.

- Reduction of Time and Effort in Selection.
- Overall employee participation in the selection process.
- Comparative ranking of SaaS products to choose from.

FIGURE 5

SURVEY ANALYSIS: BENEFIT OF SAAS SELECTION FRAMEWORK

What benefits do you want to bring in through Software-as-a-Service (SaaS) Selection and Provisioning Framework ?
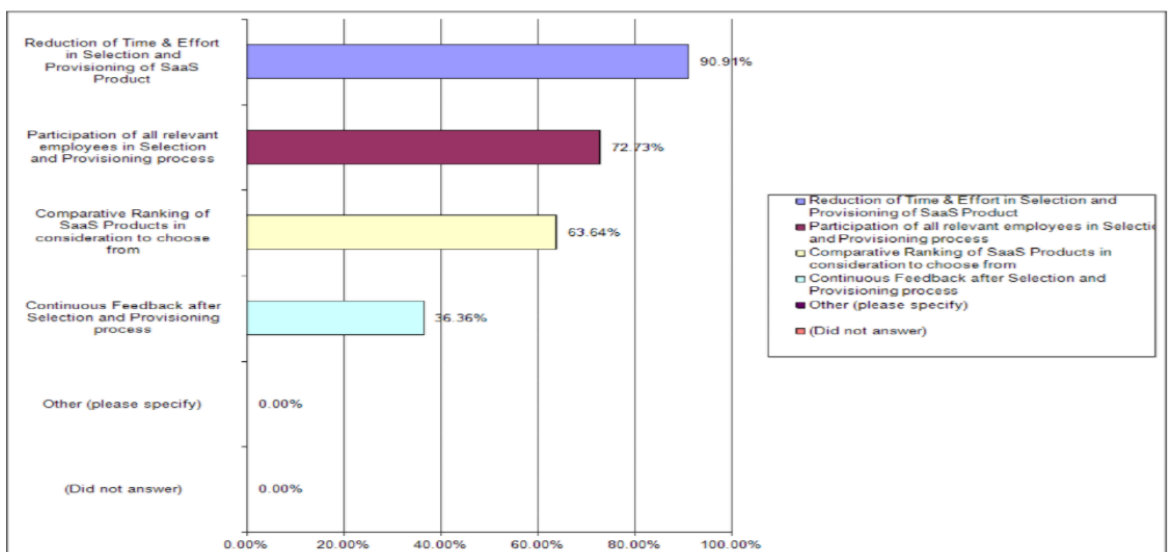
C) The main benefit for SaaS product adopts is it enable employees to focus on the core business.

D) The factors that effects the selection of SaaS products for SMEs.

- Functionality
- Cost
- Usability and
- Architecture.

FIGURE 6

SURVEY ANALYSIS: FACTORS AFFECTS SAAS PRODUCT SELECTION

What Factors (Level 1) do you think affects the choice of a Software-as-a-Service Product for your organization?
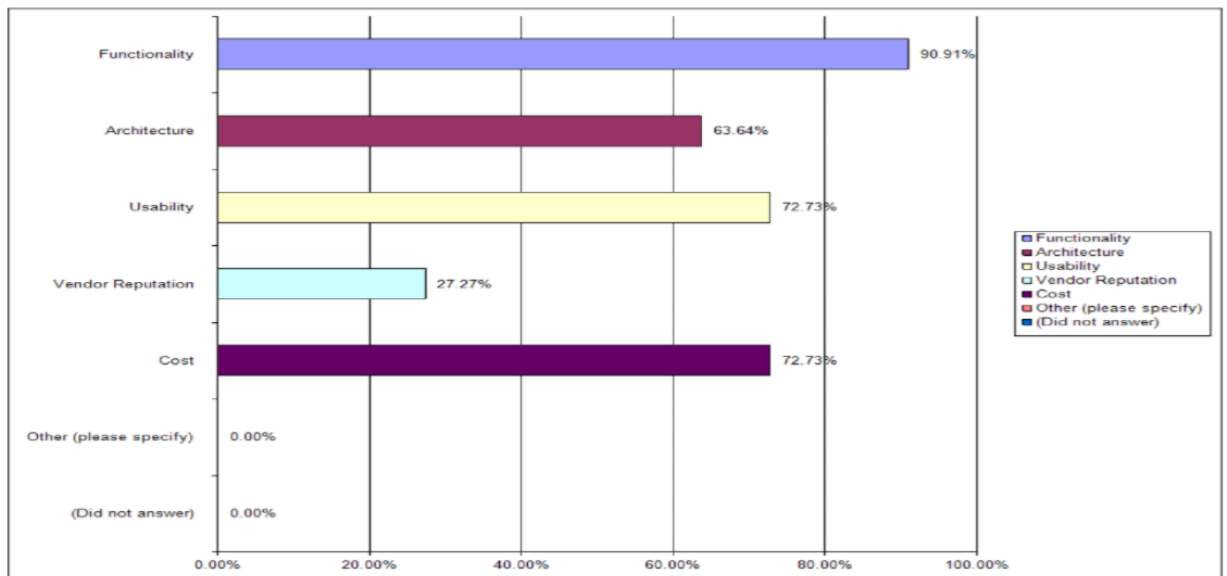
E) Considering the top answers for the factors of SaaS Product selection -

- Functionality is 5 times more important factor than Architecture.
- Functionality and Usability are Equally important.
- Functionality is 5 times more important factor than Vendor Reputation.
- Functionality and Cost are Equally important.
- Architecture and Maintainability are Equally important.
- Usability is more important than Maintainability.
- Usability is 5 times more important factor than Cost.
- Vendor Reputation and Cost are equally important.

9 Outcome

The purpose of the research is to develop a SaaS selection procedure (Framework) for selection and ranking of SaaS offerings suitable for the SMEs' organizational and their business needs involving all the stakeholders of the organization.

During the process to reach the objectives we had analyzed various methods to solve the MCDM problem. MCDM is considered to the main challenge for the SMEs which consume valuable time & money and considered to be a tiresome process. The AHP had been chosen as the best fit method for SaaS product selection as it aligns with the immediate research objectives. AHP supports group decision making, ranks the products through pairwise comparison of criteria, provides visibility through hierarchical structure of factors and attributes affects the selection and ensures no bias decision making.

Challenges of SMEs in quick and reliable selection of SaaS products and the adverse impact of wrong & delayed selection are the main drivers of the research. The AHP method provides the theoretical base of the solution meeting the research objectives. However, the implementation process of the AHP method in the case study for selection a SaaS CRM and ranking them for a SME is one of the outcomes of the thesis. The implementation process for selection of SaaS CRM is the 1st iteration of the research methodology. I considered many practical implementational challenges of SMEs and came out with a simple standard procedure of SaaS product selection. I called it 'The Framework for Selection of SaaS Product for SMEs'. The procedure though implemented manually and using third-party tools; however, could be implemented using a mobile application. The initial design of the mobile application had been done using marvel application to incorporate the outcome, the architecture and the workflow of the SaaS product selection Framework (refer appendix).

The following selections discusses a) Architecture of SaaS product selection Framework for SMEs and b) Workflow of SaaS product selection Framework for SMEs and the c) Mobile Application Design

The Figure 7 shows the Architecture of SaaS Product selection Framework for SMEs. The architecture of the framework is derived from the 1st iteration of the research methodology using the Case Study of SaaS CRM products. The architectural parts of the framework are described as follows:

9.1 Framework Overview

FIGURE 7
ARCHITECTURE OF SAAS PRODUCT SELECTION FRAMEWORK FOR SMEs

Mobile Application Design

Architecture of SaaS Product Selection Framework for SMEs
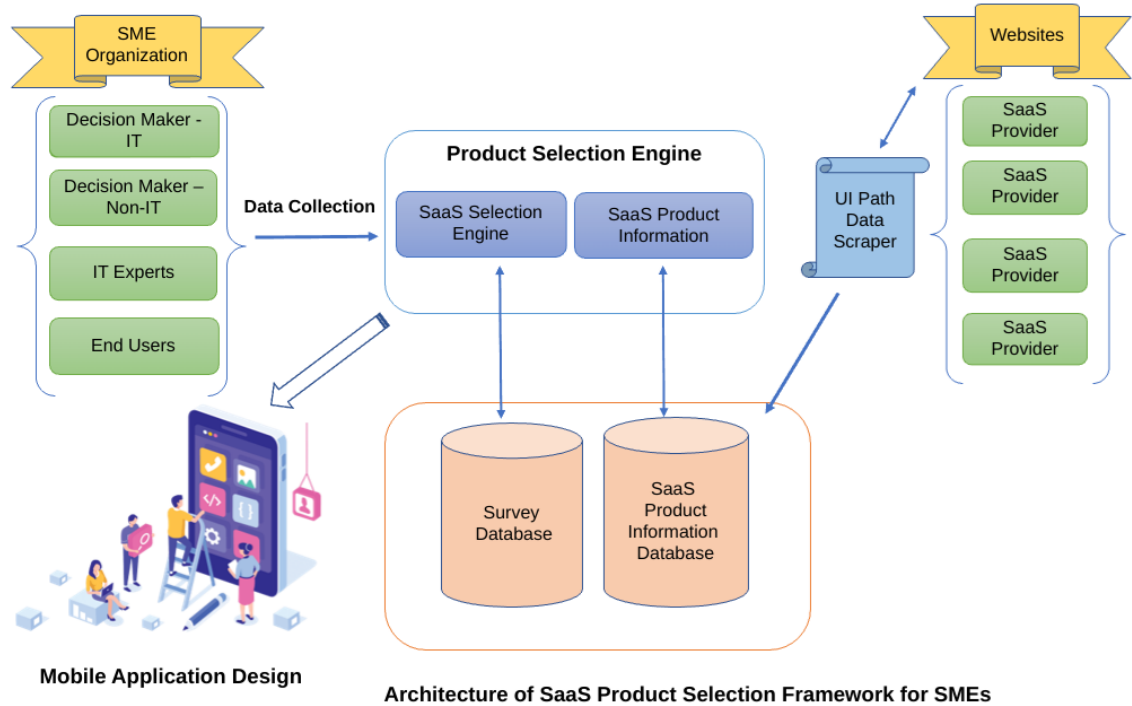
Website: SaaS provider's website offering SaaS products. The website contains the information about SaaS product, product feature, licencing information etc.

Data Scraper: Data Scraper is a automate process which crawls the website of the intended SaaS provider and extracts information about the SaaS product feature and stores into the product information database. The architecture proposes Uipath as data scraper.

Product Selection Engine: The Product Selection Engine recommend product based on the Survey results using AHP. Product selection engine consists of SaaS Selection Engine and SaaS Product Information. It internally helps of SaaS selection engine to do the pairwise comparison, calculate weights of the product features. Product selection engine prioritize the product features and then ranks the SaaS products. The Product Selection Engine will be the backbone of the mobile application which has been designed and will be developed in future.

SaaS Selection Engine: The SaaS Selection engine does the pairwise comparison and calculate the weights of the depending on the survey feedback received from the SME organizational employees.

SaaS Product Information: SaaS product information interacts with the SaaS product information Database and fetches required information of the SaaS product in

28

consideration. It provides all the required survey information to the SaaS selection engine for the calculations.

SaaS product information Database: Store all the relevant information of the SaaS products required for SaaS product selection.

Survey Database: Stores all the relevant information of the survey.

SME organization: The SME organization who wants to select a suitable SaaS product participates in the survey. The employees of the SME organization mainly, Decision Maker-IT, Decision Maker – Non-IT, IT Experts and End Users who are responsible for selection of SaaS product participates in the survey.

9.2   Framework Process

FIGURE 8
WORKFLOW OF SAAS PRODUCT SELECTION FRAMEWORK FOR SMEs

Workflow of SaaS Product Selection Framework for SMEs
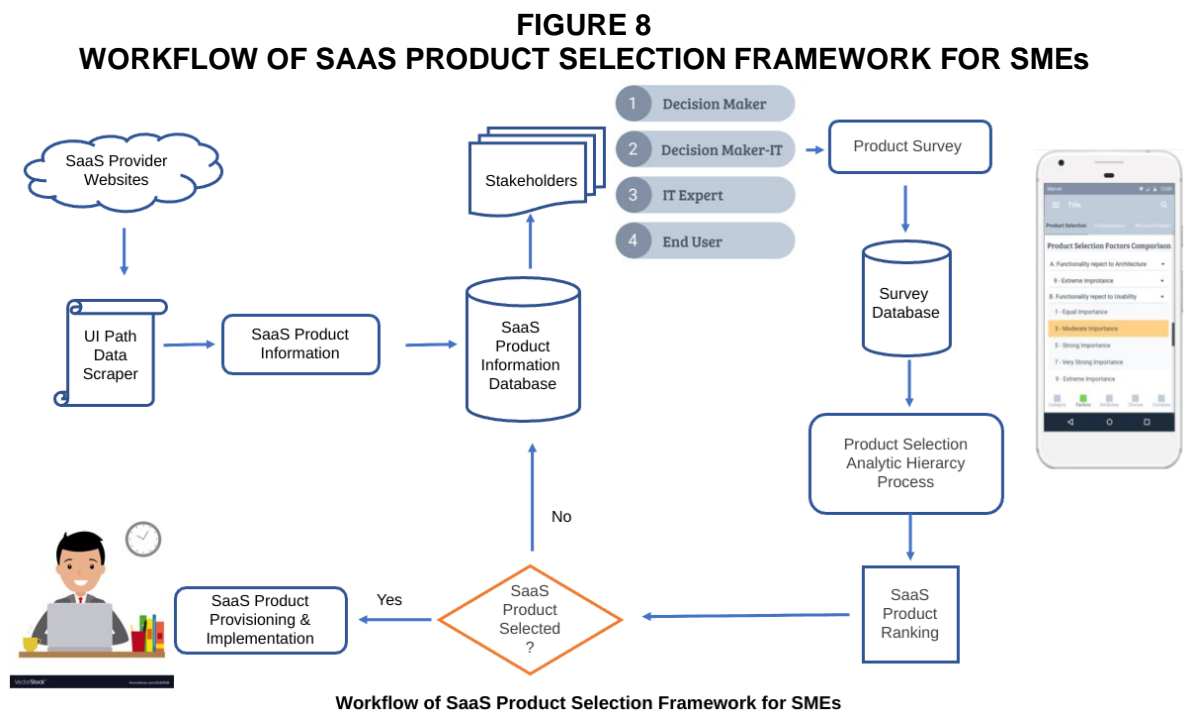
Figure 8 describes the workflow procedure of the selection of SaaS product for SMEs which is considered the main outcome of the thesis. The process would provide the SME a quick selection of SaaS product depending on the organizational needs.

The process starts with Uipath Data Scraper extracting the required information from the SaaS products under a chosen category such as CRM, ERP, HRM, Email marketing etc. The extracted SaaS product information is then stored in the SaaS Product information Database. The stakeholders of a SME organization such as Decision Maker, Decision Maker – IT, IT Experts and End User extracts the SaaS product information and study the product features before participating the Product Survey for SaaS Selection. The survey

29

responses are then stored in the Survey Database. The survey uses AHP method to select and rank the product as per the survey response. The AHP method then rank the SaaS products among the participated SaaS products as per the SME need based on the survey participation. The decision Makers of the SME takes a call on the adopting the selected SaaS product. If they are convinced, they stop the survey and proceed for the provisioning and then implementation of the selected SaaS product. Else the survey continues till a consensus in decision making is reached.

This process of selection of SaaS product for SMEs is referred to as 'The Framework for Selection of SaaS Product for SMEs'. The following section discusses the another in-line outcomes of the research, the designing of a mobile application.

9.3   Mobile Application

Mobile Application: A mobile application is designed to support the procedure of the SaaS product selection framework. The decision makers could be able to participate in the SaaS product selection using the mobile application and the application will dynamically provide the aggregated ranking of the SaaS products in selection per category per organization. The mobile application will take care all the aspect of the framework and does all the mathematical calculation in the background. Thus, the framework with the use of mobile application will give the SMEs the much-needed tool for the selection of SaaS product without much of an initial investment.

The mobile application was designed using marvel application (Marvelapp.com, 2020). The SaaS Product Selection Application has the Login credential page, Activity Selection Page, Organizational Role page, SaaS Category page, Factors Comparison Pages, Attributes Comparison Pages, SaaS Choose Pages, Product Comparison pages, Review Product page and Collaboration page (refer Appendix 3 Figure 9(A-K)).

10 Case Study

The case study is for selection of a SaaS Customer Relationship Management (CRM) product among three (3) SaaS CRM offerings at a SMEs. The case study shows how the management of an organization evaluate the criteria, sub-criteria and each alternatives affecting the selection and select a SaaS CRM product based on calculated weights of selection criteria and scores using AHP method.

Decomposition

Based on the website study of each of the SaaS CRM products the decomposition into a hierarchal structure happens. Figure – 10 shows the hierarchy considered for the SaaS CRM selection.

The highest level of the hierarchy is the overall Goal, is to construct and evaluate structure for SaaS CRM system selection with weights corresponds to criteria. Under the overall goal, the level –1 represents the Factors affecting SaaS CRM selection which includes Functionality, Architecture, Usability, Vendor Reputation and Cost. The Level-2 represents various sets of sub-criteria i.e. the attributes which are associated with each Factors in the level -1. Case study considers 23 attributes in the level - 2. The Functionality factor consists of six attributes (Sales Force Automation, Marketing Automation, Customer Support, Report & Analytics, Mobile & Social Media and Platform). The Architecture factor is sub-divided into attributes (Integration, Scalability, Security and Suitability). The usability factor made of five factors (Ease of Use, Language Support, Training, Supported Platform and Support). The vendor reputation factor includes five attributes (Number of Client, Quality Compliance, Brand Value, User Satisfaction and Data Security). Finally, the cost factor includes three attributes (Free Subscription, Annual / Monthly Subscription, One-time payment).

The prioritization procedure begins once the hierarchy structure of the SaaS CRM product selection has been constructed to determine the relative importance of the elements in each level. A questionnaire survey was designed using sogosurvey.com and delivered to around 50 professionals in Finland working in different roles like IT experts, project manager, program manager, product owner, Sales owner, Finance expert, HR executive etc for the collection of data of pairwise comparisons. The response included 11 samples with a response rate of 22 percent.

FIGURE 10

THE HIERARCHY OF SELECTION OF SAAS PRODUCT
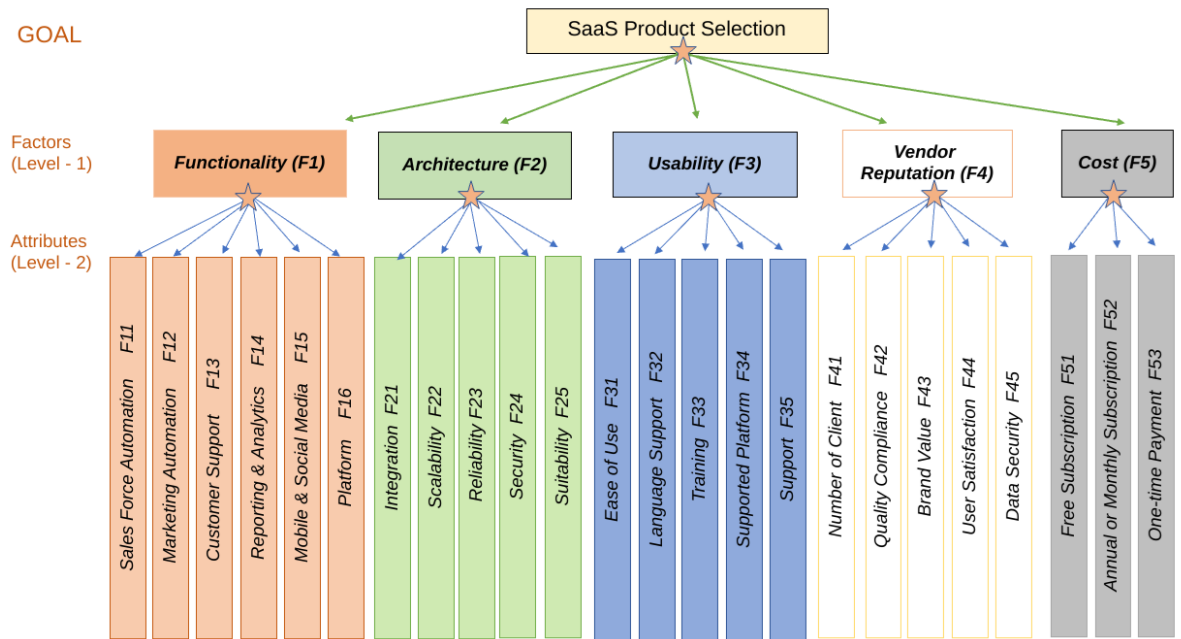
Comparative Judgement:

The respondents are asked to make judgement about the relative importance of the element with respect to the overall goal of selection of a SaaS CRM product. For example, when asked How important is Functionality compared to Architecture (A options) OR How important is Architecture compared to Functionality (B Options)? The judgemental answer of B Options Strongly was then translated into the corresponding number in the relative importance scale in table 1 which means here that Architecture is 5 times more important than Functionality. Thus, doing all the pairwise comparison at level – 1, the pairwise matrix is constructed. Similarly, the pairwise comparison procedure is then followed for all the level – 2 attributes with respect to the first level.

The IT experts participated in the survey asked to participate for the SaaS CRM selection Case Study questionnaire for choosing a SaaS CRM offering among Sales Force CRM, HubSpot CRM and Zoho CRM for their organization by answering the pairwise comparison question of two CRMs with respect to the second level.

Synthesis of Priorities:

The survey result provides the data for the pairwise comparison. The analysis starts by developing a comparison matrix at each level of the hierarchy starting from level –1. A set of Eigenvectors for each matrix has been computed and then normalize to unify the result to obtain the vectors of priorities (Ching-Fu Chen, 2006) (refer, equation 1 & 2). The vector weights are also called 'Criteria Weights. The criteria weight of the factors (Level –1) (refer Figure: 10) in the case study is called as 'Global Weight' and the criteria weight of the attributes (Level –2) in the case study is called as 'Local Weight'. The local weights of the attributes and global weights of the factors are computed using the equations (see appendix tables A1 to A7). Estimating the consistency ratio to check the consistency of judgment with the survey data has been done but failed to pass the consistency test.

The converted global weights are synthesized from the by multiplying the local weights of the attributes by the corresponding criteria weight in the level above. Table 5 describe global weights, local weights and the converted local weights of the attributes.

As considered the three chosen SaaS CRM Sales Force CRM, Zoho CRM and HubSpot CRM products are being conducted with the pair-wise one-to-one comparison survey with respect to each attribute shown at level 2 of hierarchy. This comparison provides the scoring of every product with respect to the attributes. This is the raw score of the SaaS CRM products referred in Table 6.

The local weight of every attribute and raw score of every product are multiplied to get weighted score of products for each attribute (refer Table 7). The ranked sum of weighted scores in descending order gives the ranking of the products as shown in Table. The sum show that product HubSpot CRM is the most suitable SaaS CRM product of the case study SME.

TABLE 5

GLOBAL WEIGHTS, LOCAL WEIGHTS CONVERTED GLOBAL WEIGHT

OF ATTRIBUTES

Factors	Global Weight	Attributes	Local Weight	Converted Global Weight
Functionality F1	0.2568	Sales Force Automation F11	0.0736	0.0189
		Marketing Automation F12	0.1532	0.0393
		Customer Support F13	0.316	0.0811
		Reporting & Analytics F14	0.2516	0.0646
		Mobile and Social Media F15	0.0466	0.0119
		Platform F16	0.1582	0.0406
Architecture F2	0.0244	Integration F21	0.1074	0.0026
		Scalability F22	0.1184	0.0028
		Reliability F23	0.0476	0.0011
		Security F24	0.547	0.0133
		Suitability F25	0.0476	0.0011
Usability F3	0.1498	Ease of Use F31	0.3782	0.5666
		Language Support F32	0.1792	0.0268
		Training F33	0.0826	0.0123
		Supported Platform F34	0.0718	0.0107
		Support F35	0.2856	0.0427
Vendor Reputa-tion F4	0.2212	Number of Client F41	0.296	0.0654
		Quality Compliance F42	0.263	0.0581
		Brand Value F43	0.0322	0.0071
		User Satisfaction F44	0.1902	0.042
		Data Security F45	0.3546	0.0784
Cost F5	0.347	Free Subscription F51	0.727	0.2522
		Annual or Monthly Subscription F52	0.0506	0.0175
		One-time Payment F53	0.2203	0.0764
TOTAL	**1.000**	**TOTAL**	**5.000**	**1.000**

TABLE 6

PRODUCT RAW SCORE WITH RESPECT TO ATTRIBUTE

Factors	Attributes	Raw Score of Product			Total (A+B+C)
		Sales Force CRM	HubSpot CRM	Zoho CRM	
Functionality F1	Sales Force Automation F11	0.054	0.745	0.199	1.00
	Marketing Automation F12	0.073	0.643	0.28	1.00
	Customer Support F13	0.054	0.745	0.199	1.00
	Reporting & Analytics F14	0.0583	0.7672	0.1727	1.00
	Mobile and Social Media F15	0.066	0.797	0.1393	1.00
	Platform F16	0.0649	0.652	0.254	1.00
Architecture F2	Integration F21	0.082	0.7233	0.192	1.00
	Scalability F22	0.0583	0.7672	0.1727	1.00
	Reliability F23	0.0643	0.710	0.217	1.00
	Security F24	0.0643	0.710	0.217	1.00
	Suitability F25	0.057	0.694	0.180	1.00
Usability F3	Ease of Use F31	0.057	0.694	0.180	1.00
	Language Support F32	0.0649	0.652	0.254	1.00
	Training F33	0.054	0.745	0.199	1.00
	Supported Platform F34	0.068	0.489	0.205	1.00
	Support F35	0.499	0.308	0.147	1.00
Vendor Reputation F4	Number of Client F41	0.818	0.090	0.090	1.00
	Quality Compliance F42	0.288	0.499	0.211	1.00
	Brand Value F43	0.624	0.378	0.358	1.00
	User Satisfaction F44	0.696	0.231	0.071	1.00
	Data Security F45	0.752	0.188	0.059	1.00
Cost F5	Free Subscription F51	0.054	0.745	0.199	1.00
	Annual or Monthly Subscription F52	0.05	0.727	0.195	1.00
	One-time Payment F53	0.818	0.090	0.090	1.00

TABLE 7

RANKING OF PRODUCTS

Factors	Attributes	Weighted Score of Product		
		Sales Force CRM	HubSpot CRM	Zoho CRM
Functionality F1	Sales Force Automation F11	0.0010	0.014	0.0037
	Marketing Automation F12	0.0028	0.0252	0.0109
	Customer Support F13	0.0043	0.0604	0.0161
	Reporting & Analytics F14	0.0037	0.0495	0.0111
	Mobile and Social Media F15	0.0007	0.0095	0.0016
	Platform F16	0.0026	0.0264	0.0102
Architecture F2	Integration F21	0.0002	0.0018	0.0005
	Scalability F22	0.0001	0.0022	0.0004
	Reliability F23	0.00007	0.0094	0.0002
	Security F24	0.0008	0.0008	0.0028
	Suitability F25	0.00006	0.0393	0.0002
Usability F3	Ease of Use F31	0.0032	0.0174	0.0101
	Language Support F32	0.0017	0.0092	0.0068
	Training F33	0.0006	0.0052	0.0024
	Supported Platform F34	0.0007	0.0131	0.0022
	Support F35	0.0213	0.0058	0.0062
Vendor Reputation F4	Number of Client F41	0.0535	0.0290	0.0058
	Quality Compliance F42	0.0167	0.0026	0.0112
	Brand Value F43	0.0044	0.0097	0.0025
	User Satisfaction F44	0.0292	0.0147	0.0029
	Data Security F45	0.0589	0.1873	0.0046
Cost F5	Free Subscription F51	0.0136	0.0127	0.0501
	Annual or Monthly Subscription F52	0.0008	0.0068	0.0068
	One-time Payment F53	0.0625	0.0198	0.0198
TOTAL		**0.2843**	**0.5546**	**0.1749**

11 Conclusion

The research has developed a standard architecture and workflow procedure for the SaaS product selection using the AHP method. The AHP method enabled group participation and ensured stakeholder participation in decision making process. End user also participated in the selection process and provided their opinion for End User satisfaction. The developed procedure for SaaS selection using AHP method evaluated criteria weights for all the attributes of selection, prioritise them and ranked the product alternatives for selection. Thus, the decision-making for SaaS selection becomes transparent, inclusive and no-bias decision which ensured end user satisfaction. Hence, Research Objective 1 met. The selection procedure proposed is simple to use, easy to understand and could be implemented without extra cost. The process reduced significant time of selection though with the use of mobile application time could be reduced further. Hence, Research Objective 2 met. The AHP method is chosen for the SaaS selection procedure to rank the product alternatives. The hierarchy structure of factors and attributes for SaaS selection created clarity, visibility among the decision makers. Hence, the Research Objective 3 is also materialized. Other than the three immediate research objectives the Research Objective 4 to design the mobile application has been met. The research has been able to design a mobile application for the SaaS selection using research methodology. The mobile application in future be able to store data for future use. The Research Objective 5 to incorporate the continuous feedback had been designed in the mobile application via collaboration tab. A bot under the collaboration tab, interacts with the user (the stakeholders of selection), resolves all the queries and captures the feedback to improve user satisfaction and selection process which can be included in the SaaS product selection framework as improvements, later.

The research questions asked during interview and survey questionnaire, not always revealed direct answers. The literature review and websites of the SaaS provided better understanding of RQ 1 & 2 to understand the factors and attributes. The RQ 3 had been answer positively by the respondents. Most of them think reduction in time and effort in selection is the top benefits the SaaS product selection Framework could bring to the SMEs. Strongly Agree (9.09 %), Agree (36.36 %), Neutral (27.27%) think the need for a standard procedure for selection of SaaS products. Though measurement of the success of the SaaS selection procedure is difficult, however evaluating KPI's like customer satisfaction, ensuring all stakeholder participation, ranking the product alternatives creates greater influence for adopting this transparent, no-bias decision-making process.

The Future work is to continue with the iterations of SaaS selection methodology for other categories of the SaaS products required for the SMEs. Thus, will full proof the factors and attributes of SaaS selection per product category. The mobile application design will be improved as per the need and the development work of it would the main task for the future.

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Appendices

Appendix 1. Survey Questionnaire

SaaS Selection Questionnaire:

Q1: How Software-as-a-Service (SaaS) helped your organization?

Q2: Have you participated in any Decision-Making process of SaaS Selection in past?

Q3: Do you feel the need of a Framework for Software-as-a-Service (SaaS) Product Selection and Provisioning?

Q4: What benefits do you want to bring in through Software-as-a-Service (SaaS) Selection and Provisioning Framework?

Multi-criteria Decision-Making (MCDM) Questionnaire:

Q5: What Factors (Level 1) do you think affects the choice of a Software-as-a-Service Product for your organization?

FACTORS (Level 1):

Example Question: How important is Functionality compared to Architecture (A options) OR How important is Architecture compared to Functionality (B Options) ?

Example Answer: B Options Strongly: 5. Means Architecture is 5 times more important than Functionality.

ATTRIBUTE (Level 2): Functionality

Example Question: How important is Sales Force Automation compared to Marketing Automation (A options) OR How important is Marketing Automation compared to Sales Force Automation (B Options)?

Example Answer: A Options Moderately: 3. Means Sales Force Automation is 3 times more important compared to Marketing Automation.

Case Study Questionnaire:

Example Question: How important is Sales Force - Sales Force Automation compared to Zoho - Sales Force Automation (A options) OR How important is Zoho - Sales Force Automation compared to Sales Force - Sales Force Automation (B Options)?

Example Answer: B Options Very Strongly: 7. Means Sales Force - Sales Force Automation is 7 times more important compared to Zoho - Sales Force Automation.

Appendix 2. Pairwise Comparison Matrix

TABLE A1

PAIRWISE COMPARISON OF FACTORS WITH RESPECT TO THE GOAL

Goal	F1	F2	F3	F4	F5	Local Weight
F1	0.088	0.304	0.105	0.006	0.781	0.2568
F2	0.012	0.043	0.034	0.011	0.022	0.0244
F3	0.088	0.13	0.105	0.404	0.022	0.1498
F4	0.8	0.217	0.015	0.057	0.017	0.2212
F5	0.017	0.304	0.739	0.519	0.156	0.347

TABLE A2

PAIRWISE COMPARISON OF FUNCTIONALITY WITH RESPECT TO THE FACTORS

Goal	F11	F12	F13	F14	F15	Local Weight
F11	0.071	0.119	0.034	0.092	0.052	0.0736
F12	0.071	0.119	0.034	0.281	0.261	0.1532
F13	0.357	0.599	0.174	0.281	0.156	0.316
F14	0.214	0.119	0.174	0.281	0.47	0.2516
F15	0.071	0.023	0.057	0.030	0.052	0.0466
F16	0.214	0.017	0.523	0.030	0.007	0.1582

TABLE A3

PAIRWISE COMPARISON OF ARCHITECTURE WITH RESPECT TO THE FACTORS

Goal	F21	F22	F23	F24	F25	Local Weight
F21	0.055	0.348	0.047	0.071	0.016	0.1074
F22	0.007	0.049	0.428	0.071	0.037	0.1184
F23	0.055	0.005	0.047	0.094	0.037	0.0476
F24	0.496	0.447	0.333	0.664	0.795	0.547
F25	0.385	0.149	0.142	0.094	0.113	0.1766

TABLE A4

PAIRWISE COMPARISON OF USABILITY WITH RESPECT TO THE FACTORS

Goal	F31	F32	F33	F34	F35	Local Weight
F31	0.225	0.734	0.411	0.428	0.093	0.3782
F32	0.032	0.104	0.294	0.183	0.283	0.1792
F33	0.032	0.02	0.058	0.02	0.283	0.0826
F34	0.032	0.034	0.176	0.061	0.056	0.0718
F35	0.677	0.104	0.058	0.306	0.283	0.2856

TABLE A6

PAIRWISE COMPARISON OF VENDOR REPUTATION WITH RESPECT TO THE FACTORS

Goal	F41	F42	F43	F44	F45	Local Weight
F41	0.037	0.034	0.043	0.019	0.015	0.296
F42	0.333	0.31	0.391	0.136	0.145	0.263
F43	0.037	0.034	0.043	0.027	0.02	0.0322
F44	0.259	0.31	0.217	0.136	0.029	0.1902
F45	0.333	0.31	0.304	0.681	0.145	0.3546

TABLE A7

PAIRWISE COMPARISON OF VENDOR REPUTATION WITH RESPECT TO THE FACTORS

Goal	F51	F52	F53	Local Weight
F51	0.819	0.473	0.89	0.727
F52	0.09	0.052	0.01	0.0506
F53	0.09	0.473	0.098	0.2203

Appendix 3. Mobile Application Design (Confidential)