1. INTRODUCTION

1.1 Management Information System

The direction of enterprises is changing continuously due to the changing trends in a market. The management function is facing an increasing number of challenges for maintaining a track of all the diverse organizational sources (Nowduri, 2014). The diverse changes put a pressure on the organizations to make their decisions more efficiently. Especially operational, tactical and strategic decisions at different levels of organization should be extra active and successful (Kornkaew, 2012).

So, the highly competitive environment demands the evolution of Information Systems. An information system (IS) is a combination of different components like data, software, hardware, procedures and people. These components help to increase competitiveness and to gain valuable and timely information. Information System (IS) becomes Management Information System (MIS) when this system helps the managers in decision making (Kornkaew, 2012).
According to (Nowduri, 2014) the MIS is primary to the functioning of the corporation as it collects uncooked information from numerous ends, converts it into beneficial records, and sends it to the components of the enterprise. Thereby pleasing the information needs of individuals, teams and management respectively.

![Components of Information System](source: Kornkaew, 2012)

In line with Figure 1, the major factors of IS include hardware, computer code, statistics, approaches, and individuals. Hardware includes pcs, garage disks, keyboards even a software is applicable to phrase-processing programs. Records or information includes texts, phrases, sentences, and paragraphs in reviews. Also, methods check with the methods for the use of this system and involved tasks. The final factor is humans. The critical function of 5 components is this IS being most effective computers and applications however it also specializes in the meeting of hardware, computer code, facts, strategies. So, information device means a machine of verbal exchange among human beings (Kornkaew, 2012).

### 1.2 The Need of Hybrid Approaches for Information System (Is) or Management Information System Development

One development methodology is not suitable for all the organizations due to changing environment and every project need a distinctive technique to fulfill the dreams and goals. It approaches “one length is not match for all”. Every approach has its personal pros and cons. By combining the advantages and by ignoring or reducing the weaknesses of two or more procedures a better software program or a system can be accomplished (Castilla, 2014). Due to which corporations are transferring towards the exceptional hybrid methods that integrate two or extra software methodologies thereby improving the whole improvement.
2. LITERATURE GAP

Table 1. Literature Summary

<table>
<thead>
<tr>
<th>Title</th>
<th>Author</th>
<th>Contribution</th>
<th>Weaknesses</th>
</tr>
</thead>
<tbody>
<tr>
<td>Empirical Evaluation of the Proposed eXSCRUM Model (2012)</td>
<td>M.Rizwan Jameel Qureshi</td>
<td>• Combines the scrum and XP by removing their drawbacks.</td>
<td>• No approval is taken from the customer at the end of each iteration which reduces the customer satisfaction level.</td>
</tr>
<tr>
<td>IXSCRUM-A Framework Combining Scrum and XP (2013)</td>
<td>Chhavi Malhotra, Anuradha Chug</td>
<td>• Performs testing again and again to reduce defects.</td>
<td>• Lack of planning about enterprise objectives.</td>
</tr>
<tr>
<td>IXSCRUM: Hybrid Software Development Model Integrating Extreme Progr</td>
<td>Nidhi Sharma, Manoj Wadhwa</td>
<td>• Combines the Scrum, XP and RUP by considering their strengths.</td>
<td>• Roles and artifacts of the proposed framework are not defined properly.</td>
</tr>
<tr>
<td>A Comparative Analysis of DXPRUM and DSDM (2017)</td>
<td>Muhammad Fahad et al.</td>
<td>• Combines XP and Scrum with DSDM.</td>
<td>• Single dimension prioritization take place.</td>
</tr>
<tr>
<td>Agile Methodology: Hybrid Approach Scrum and XP (2017)</td>
<td>Farrukh Musa, Muhammad Ali Tariq</td>
<td>• Takes the customer approval in each iteration.</td>
<td>• Prioritization technique is not mentioned for the classification of requirements in system backlog phase.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Saves client money and time.</td>
<td>• No design centered approach is implemented.</td>
</tr>
</tbody>
</table>

2.1 Problem Statement

The existing Scrum/XP hybrid approaches focuses on the single perspective prioritization approach for the classification of requirements (Sharma & Wadhwa, 2015). They also lack practices about full
life cycle (Musa & Tariq, 2017). Furthermore, the current work focuses more on development and testing during iteration rather than using any design centered approach (Fahad et al., 2017). So these issues needs to be addressed properly.

2.2 Description of Framework

This research proposed a framework with the aim to mitigate the issues which are still uncovered by the hybrid approaches of XP and Scrum. The framework includes the engineering approaches of XP which are combined with the management approach of Scrum. Further it also defines the roles along with the whole cycle. The framework includes the following phases.

2.3 Feasibility Study

The primary objectives of this phase are to 1) identify the business scope of the new system 2) develop preliminary cost and schedule estimates based on the stakeholder concurrence, 3) identify the business need for the project, 4) understand the requirements according to the business case for the project, 5) establish a vision for the solution the business modeling discipline is highly utilized in this phase. The main activities of the business modeling discipline in this phase include: 1) create a list of business benefits, system objectives and system capabilities, 2) describe the problem or need, 3) consider business process, workflow, and interfaces to other systems, and 4) analyze the various system stakeholders.

2.4 Product Attribute

The product attribute is the user stories or the user requirements elicited in the previous phase.

2.5 Estimation

The product attributes are then estimated based on the effort required to build the requirements. The cost related to each requirement is also estimated in this phase.

2.6 Requirement Prioritization

After estimation the requirements are prioritized by using VIEWPOINT technique. The viewpoint technique considers the viewpoints of every stakeholder so that the requirements are identified from different perspectives. This technique is based on the assumptions that the entire system cannot be covered with the single perspective. Now there is a need to prioritize the VIEWPOINTS based on their criticality.

2.7 Product Backlog

The product backlog is the list of requirements after estimation and prioritization needs to develop. The development of these requirements splitted in the form of short iterations called sprints.
2.8 Sprint Development Cycle

Sprint development cycle involves 5 phases:

- **Plan:**
  The planning phase involves the planning of a sprint that which requirements needs to be covered in the sprint taken by the team according to the priority.

- **Design:**
  The design includes the two types of diagrams the class diagram for the front end (interface) and object diagram for the backend (database). The design includes an XP practice simple design to Keep It Simple (K.I.S).

- **Coding:**
  The coding is done after the design phase which involves the pair programming, code review, code refactoring and coding standards.

- **Testing:**
  The testing involves the unit testing. Every feature/attribute of the product is designed, applied and tested with in the sprint improvement cycle.

- **Demo:**
  After performing all the phases now, the last step is to take the customer approval so that rather than to change large amount of code according to the customer requirement, the approval is taken from him.

2.9 Integration

The requirements approved by the customer are integrated into the system by using the continuous integration practice of XP. So that the working attributes are only integrated into the system. Otherwise the changed requirements become a part of product attribute which is again estimated and prioritized.

2.10 Sprint Review

After each sprint the sprint review meeting is conducted to check the progress of the team the issues faced by them during development and the planning of next sprint.

2.11 Deployment

The working system is deployed to the customer which is then further maintained if required.

2.12 Roles

The roles and responsibilities are taken from Scrum.

- **Product Owner:**
  The product/project owner is the voice of stakeholders. They deliver value to business and write a requirement in form of user stories and prioritize them then adds them to product backlog. They are the ones who manage, control the product backlog list.

- **Scrum Master:**
  He/ She implement the regulations and make sure that product is accomplished smoothly. He /she make certain that the project is performed in keeping with the practices, values and regulations of scrum and it progresses as planned. Scrum grasp interacts with the development group as well as with the client and the control at some point of the task.

- **Scrum Team:**
  Scrum team is the team that has authority to decide on the necessary actions and to organize itself to achieve the goals of sprint. The team estimates the effort, creates and review the sprint backlog.

- **Developer, Customer and Tester:**
  They serve their respective roles but according to the sprint and work is divided in each iteration.
3. METHODOLOGY

After proposing a framework, to check the effects of new proposed approach by combining Scrum and XP there is a need to evaluate the proposed framework. This section discusses the evaluation of proposed framework by using a survey technique and then its results are discussed. Its affect is checked on software industry by taking the views of software developers and project managers. After that the comparative analysis is performed.

3.1 Survey based evaluation

The survey is conducted online by using a Survey Monkey tool which is very useful to create surveys and to track the results from anywhere and from any device.

The research includes the 11 questions which are related to the framework to analyze the related unsolved issues. The total respondents are 55. Different software people including software developers, software engineers, project managers and system developers answered the survey questions to evaluate to the proposed work. They preferred the hybrid use of Scrum a management methodology and XP a development methodology to develop and to manage the system or software.

3.2 Survey Conduction

The data is collected through the Linkedin, Facebook, Messenger and by email. As there are different ways to collect responses from people like by sending a web link, through email, social media, and website. The collectors are added according to the choice. There is a link of every way to send it to the appropriate people which help them to fill out the questionnaire.
4. RESULTS AND DISCUSSION
4.1 Survey results
Table 2 shows the results of survey which includes mean, Std deviation and variance of each question.

<table>
<thead>
<tr>
<th>Questions</th>
<th>Mean</th>
<th>Std. Deviation</th>
<th>Variance</th>
</tr>
</thead>
<tbody>
<tr>
<td>Q1</td>
<td>13.75</td>
<td>2.061</td>
<td>4.25</td>
</tr>
<tr>
<td>Q2</td>
<td>11</td>
<td>5.33</td>
<td>28.5</td>
</tr>
<tr>
<td>Q3</td>
<td>13.75</td>
<td>5.72</td>
<td>32.83</td>
</tr>
<tr>
<td>Q4</td>
<td>18.333</td>
<td>4.163</td>
<td>17.33</td>
</tr>
<tr>
<td>Q5</td>
<td>11</td>
<td>2.64</td>
<td>6.972</td>
</tr>
<tr>
<td>Q6</td>
<td>11.4</td>
<td>3.12</td>
<td>9.7344</td>
</tr>
<tr>
<td>Q7</td>
<td>11</td>
<td>2.67</td>
<td>7.12</td>
</tr>
<tr>
<td>Q8</td>
<td>11</td>
<td>3.11</td>
<td>9.67</td>
</tr>
<tr>
<td>Q9</td>
<td>11</td>
<td>2.71</td>
<td>7.344</td>
</tr>
<tr>
<td>Q10</td>
<td>11</td>
<td>4.28</td>
<td>18.31</td>
</tr>
<tr>
<td>Q11</td>
<td>11</td>
<td>2.99</td>
<td>8.94</td>
</tr>
</tbody>
</table>

Figure 4: Statistical Analysis of Each Question
4.2 Comparative analysis

As seen in the table below, the proposed model is examined after comparison with few existing models, to obtain the results. This assessment is based on some known factors.

<table>
<thead>
<tr>
<th>Characteristics</th>
<th>Proposed Model</th>
<th>eXSCRUM</th>
<th>IXSCRUM</th>
<th>eXSRUP</th>
<th>DXPRUM</th>
</tr>
</thead>
<tbody>
<tr>
<td>Customer approval during iteration</td>
<td>Yes</td>
<td>No</td>
<td>No</td>
<td>No</td>
<td>No</td>
</tr>
<tr>
<td>Covering whole SDLC</td>
<td>Yes</td>
<td>No</td>
<td>No</td>
<td>Yes</td>
<td>No</td>
</tr>
<tr>
<td>Design centered approach</td>
<td>Yes</td>
<td>No</td>
<td>No</td>
<td>No</td>
<td>No</td>
</tr>
<tr>
<td>Multiple dimension prioritization</td>
<td>Yes</td>
<td>No</td>
<td>No</td>
<td>No</td>
<td>Yes</td>
</tr>
</tbody>
</table>

5. CONCLUSION

The direction of organizations is changing continuously due to the changing trends in a market. It puts a pressure on the organizations to make their decisions more efficiently. Especially operational, tactical and strategic decisions at different levels of organization should be more efficient and effective. Due to this reason, many organizations now use the information systems to gain competitive advantage in market. Management Information System (MIS) is an of information system that helps the managers to make tactical decisions more effectively (ArtitKornkae, 2012).

Many different agile approaches like Scrum, XP, Lean etc. are used for the development of such software and systems. Hence, it is called Agile information system development (AISD). The hybrid approach facilitates the whole development life cycle of Information systems by combining two or more methodologies. According to some researchers, it gives the better results by overcoming the weaknesses of the methodologies and by improving their advantages.

The primary focus of this research is to understand the concept of Management Information Systems, how the combination of Scrum and XP are used for the development and management of
Information systems. It also investigates the issues which are still uncovered by their hybrid combination. The literature review is carried out to study the previous work on it and to find out the issues faced by these approaches. The framework is proposed which includes the engineering approaches of XP, combined with the management approach of Scrum. Further it also defines the roles along with the whole cycle. It mitigates the issues which are uncovered.

After proposing a framework, it is evaluated by conducting an online survey. The survey is conducted by using a Survey Monkey tool which is very useful to create surveys and to track the results from anywhere and from any device. The survey includes the 11 questions. Different software people including software developers, software engineers, project managers and system developers answered the survey questions. The respondents of each question are 55. Their responses are shown by using a bar chart.

6. SUMMARY

Due to the changing environment many organizations now use the information systems to gain competitive advantage in market. Many different agile approaches like Scrum, XP, Lean etc. are used for the development of such software and systems. Hence, it is called Agile information system development (AISD). The hybrid approach facilitates the whole development life cycle of Information systems by combining two or more methodologies.

The hybrid technique of Scrum and XP is likewise utilized by enterprises in recent times. It includes the great practices of XP like pair programming, continuous integration, code assessment, coding standards, collective code ownership, refactoring and so on. Alongside, the control technique of Scrum which involves product backlog, sprints, each day standup conferences, sprint review and sprint retrospective.

Distinctive researchers work on their hybrid combinations to advantage extra benefit from them and to limit their boundaries.

This thesis tried to understand the concept of Management Information Systems, how the combination of Scrum and XP are used for the development and management of Information systems. It also investigates the issues which are still uncovered by their hybrid approach. The literature review is carried out to study the previous work on it and to find out the issues faced by these approaches. The survey is conducted to evaluate the proposed approach. Finally the results are shown which shows that previous issues are covered.

7. REFERENCES


Han, B., & Xie, J. (2012). Practical experience: Adopt agile methodology combined with kanban for virtual reality development.


