CENTERIS – International Conference on ENTERprise Information Systems / ProjMAN – International Conference on Project MANagement / HCist – International Conference on Health and Social Care Information Systems and Technologies 2022

Analysis of Project Management Tools to support Knowledge Management

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Abstract

Knowledge Management is an essential element for the successful implementation of projects. Due to the temporary nature of the projects and the teams that participate in them, the transfer, integration, and management of knowledge among projects is vital to promote sharing best practices, and to avoid the repetition of previous mistakes, in order to increase the probability of success for the projects and the organization. For this reason, Project Management tools can play a significant role in supporting Knowledge Management. The goal of this paper is to analyze and evaluate the project management tools of the Gartner Leader quadrant (2019 Gartner Magic Quadrant) regarding their potential for the Capture, Storage, Sharing and Application of knowledge, according to the artifacts in the PMBOK [1], and determine which are the best options. Gartner's leader tools were compared to Confluence, referenced as a great choice for knowledge and project document management. For the development of the artifact was used the Design Science Research (DSR) methodology. The application that obtained the highest score was Targetprocess.

Keywords: Project management; Knowledge management; Project management tools

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1. Introduction

Organizations and businesses have been facing several challenges. The transition from an industrial economy to a knowledge and information-based economy has made organizational knowledge emerge as the most critical resource for organizations [2]. Since the amount of information produced in organizations is increasing, [3] states that organizations that leverage their knowledge, technological capabilities, and innovative experiences are more likely to succeed. In addition, the work carried out by organizations often involves projects, and these play a key role in creating new business opportunities in an increasingly competitive market environment [4] .

According to [5], all projects have one thing in common: knowledge. Therefore, it is important to develop an environment for creating, sharing, and using knowledge to achieve the intended results for the project. However, as a result of the temporary nature of the projects, the knowledge that is generated in their course is tacitly kept and only shared among the project team members [6], which makes it difficult to implement procedures for capturing and sharing experience and knowledge in projects [7]. The greatest challenge for organizations and project managers lies in finding a way to structure all the data produced, store them and direct them so that they are shared among all stakeholders, thus ensuring the business evolution [8]. Through the use of project management tools, it is possible to mitigate some of these problems, and assist in the planning, organization and management of a varied set of resources.

This research work aims to analyse and evaluate the potential of project management tools to manage the knowledge that is generated in the course of projects. The objective is to evaluate the project management tools positioned in the Gartner Leader quadrant (2019 Gartner magic quadrant for project and portfolio management), in terms of their potential for capturing, storing, sharing and applying knowledge based on support for the PMBOK artifacts [1]. In this way, it will be possible to analyse how these tools can assist in managing the knowledge generated in the course of projects.

2. Theoretical background

2.1. Project management

According to the PMBOK Guide [1], project management is the application of knowledge, skills, tools and techniques to project activities in order to meet project requirements. Project teams can achieve the desired results through different approaches such as predictive, hybrid or adaptive methodologies. Based on the PMBOK Guide [1], which will support this study, eight performance domains are identified: Stakeholders; Team; Development approach and life cycle; Planning; Project work; Delivery; Performance; and Uncertainty. [1] defines domain as a group of related activities that are critical to the efficient delivery of project objectives. The specific activities undertaken in each performance domain are determined by the context of the organization, project, deliverables, project team, stakeholders and other factors. In the context of these domains, the PMBOK Guide [1] lists a set of artifacts, which are divided into categories. Some performance domains are more likely to make use of specific artifacts. According to the guide, an artifact can be defined as a template, a document, a product or a project deliverable. Regarding the type of artifacts, nine categories are defined: "Strategy artifacts"; "Logs and Register"; "Plans"; "Hierarchy charts"; "Baselines"; "Visual Data and Information"; "Reports"; "Agreements and contracts" and "Other artifacts".

2.2. Knowledge Management

Knowledge is defined by several authors, and it is not possible to classify it according to a single perspective. [9] was the first to consider the existence of two types of knowledge: tacit and explicit. According to the author, tacit knowledge is inherent to the individual, even if unconsciously, and is difficult to be transmitted or even identified. Explicit knowledge, on the other hand, is codified, expressed in formal language, easily transmissible and storable, and takes the form of words and algorithms. From [10] viewpoint, knowledge is information combined with experience, context, interpretation and reflection, being highly valuable and ready to be used in decision making and actions. Currently, all organizations intend to successfully implement business strategies, achieve their goals,

optimize the use of their human resources and gain competitive advantage [11]. In this way, knowledge management can play a significant role in organizations, helping to effectively deal with possible adversities, increasing productivity and paving the way for development and innovation [12]. [13] states that knowledge management is defined by converting data, experience and expertise into reusable and useful knowledge that is shared with the people who need them Organisations by managing knowledge efficiently, will be able to use information and consult previous experiences, with the aim of improving results compared to work previously done.

Regarding the knowledge management life cycle, several authors propose different models and nomenclatures. [14], unavoidable figures of knowledge management, state that knowledge is created through four processes: Socialisation, Externalisation, Combination and Internalisation. In [15] perspective, knowledge management requires a structuring principle that helps classify the different types of activities and functions necessary to manage all knowledge-related work within or among organizations. This framework is then presented in the form of a knowledge management theory or model that describes the main activities of the knowledge management life cycle. The same author compared and validated several approaches to the knowledge management life cycle presented by several authors [16] [17] [18] and identified three main stages. As such, he presented an integrated model of the knowledge management life cycle based on three main, ongoing processes: (i) creation and capture of knowledge; (ii) dissemination and sharing of knowledge; (iii) acquisition and application of knowledge.

2.3. Knowledge Management in Projects

The link between knowledge management and project success is particularly relevant for Information Technology projects because the task of developing and implementing business catalyst systems involves intensive knowledge activities. While construction projects involve large amounts of physical materials, the projects use knowledge as their main input material [19]. According to the PMBOK Guide [1], knowledge management in projects is the process of using existing knowledge to create new knowledge in order to achieve the project objectives and contribute to organizational learning. This process allows for the maximum leverage of organizational knowledge to produce or improve project results, and for the knowledge created by the project to be available to support organizational operations and future projects. Organizations need to share the knowledge generated in the course of projects, thus making future tasks and projects easier. For this reason, some organizations may benefit from technological tools that assist this process [20]. Project Management tools, allow for example to evaluate the workload of the team members, determine the schedule for the project tasks or prepare reports with the progress and status of the project. These tools, when used by all team members team members, end up being a means of capturing, storing, sharing and applying the knowledge that is generated during projects, and can assist in the management of that knowledge.

3. Methodology

The methodology used to develop this research paper was based on Design Science Research (DSR), presented by [21] to develop an analysis and evaluation framework of the Leader quadrant tools of the Gartner Magic Quadrant for project and portfolio management (2019), regarding their potential for capturing, storing, sharing and applying knowledge, according to the PMBOK artifacts. Five steps were undertaken to design this artifact of analysis: (i) Problem identification and Motivation: the literature reveals that it is a challenge for teams to avoid the loss of contextualised knowledge of the project when they disband [19], also noting a difficulty in the implementation in projects, of procedures for sharing experiences, knowledge and learning [22]; (ii) Solution's objectives definition: design of a framework to assess and compare the different tools regarding their ability to manage knowledge in the context of projects; (iii) Design and development: defining the dimensions and structure of the framework; (iv) Demonstration and Evaluation: experimentation and testing of the applications from Gartner's Leader quadrant (2019), comparing their features and functionalities. At the end of this stage, it is possible to repeat step three to try to improve the effectiveness of the artifact. As such, some changes were made to the framework structure until reaching a final stable version; (v) Communication: publication of the research work to communicate around the importance of the problem and the utility of our solution.

4. Analysis framework and tool selection

The first step in the design and development of the framework was the identification of the scope of the dimensions. Thus, it was considered relevant to perform an analysis of the applications based on the PMBOK artifacts [1]. They are grouped by type in the framework. The choice of applications to be evaluated was based on the Gartner magic quadrant for project and portfolio management (2019), through the adoption of the applications ranked as "Leader", as these provide the highest value and capability. The applications are as follows: Trello, Jira, QuickBase, Smartsheet, Wrike, Asana and Targetprocess. Additionally, Confluence was included as a comparison benchmark. This application presents positive references [23][24][25] as a reliable option for project document and knowledge management. It is important to mention that for this study only trial versions of the applications were used and therefore some features were not tested in full, however documentation on their usage was sought.

Through the framework, it was intended to assess whether the chosen applications were able to provide support for the several types of artifacts mentioned in the PMBOK [1] and in which way they contributed to knowledge management in the context of projects, particularly their contribution to the capture, storage, sharing and application of knowledge. Considering the wide diversity of knowledge management life cycle models created and the number of authors presenting different perspectives of knowledge management models [26][15][16][27], a model was chosen as the basis for this study that presented the three major phases of knowledge management cycle and that would allow for the development of a simple and intuitive application ranking system. Therefore, Dalkir's original model [15] was adapted for this purpose. The tools were then tested and assessed, taking into account a ranking system based on that adaptation. The author's original model only included the stages of Capture/Creation; Sharing and Dissemination; Acquisition and Application. It was decided to simplify the stages' names, in order to simplify the acronym with their initials, and it was also added the "Storage" stage that several authors included in their concepts [28][26], as it was considered to be an important feature to analyse in the project management tools domain. In this way, the adapted model includes the following stages: (i) Capture: identification and subsequent codification of knowledge; (ii) Storage: accumulating knowledge in a knowledge base or repository; (iii) Sharing: through direct access to the knowledge repository or transmission of data; (iv) Application: collecting and organising the required information for decision-making. Figure 1 presents the corresponding model.
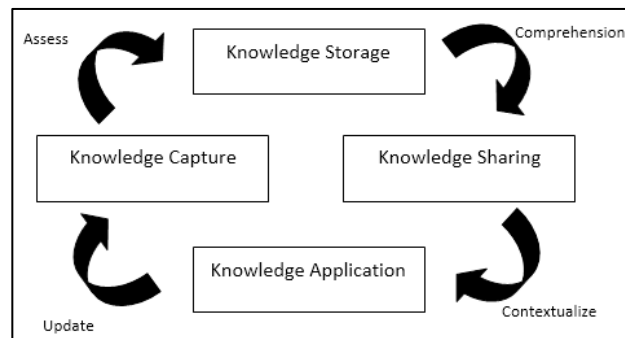

Figure 1: Adapted model of the Knowledge Management life cycle [15].

Based on these four concepts, the tools' capabilities were evaluated taking into account the artifacts supported. For knowledge capture, it was checked whether the tools enabled the identification and codification of knowledge. Storage was assessed considering the applications' capabilities to store content and information through the artifacts. Sharing was validated if the applications enabled sending or sharing the artifacts directly through the platform itself, and the Application was analysed through the artifacts with decision-making capability, typically produced after data collection and analysis. They mainly include artifacts that organize and present data and information in a visual format, such as charts, graphs, matrices, and diagrams. The study concerns the capture, storage, sharing and application of knowledge in a project management context, oriented to the evaluation of the project management tools capacities. In Figure 2 it is possible to visualise the graph regarding the knowledge Capture potential for the various applications, divided by type of artifacts.
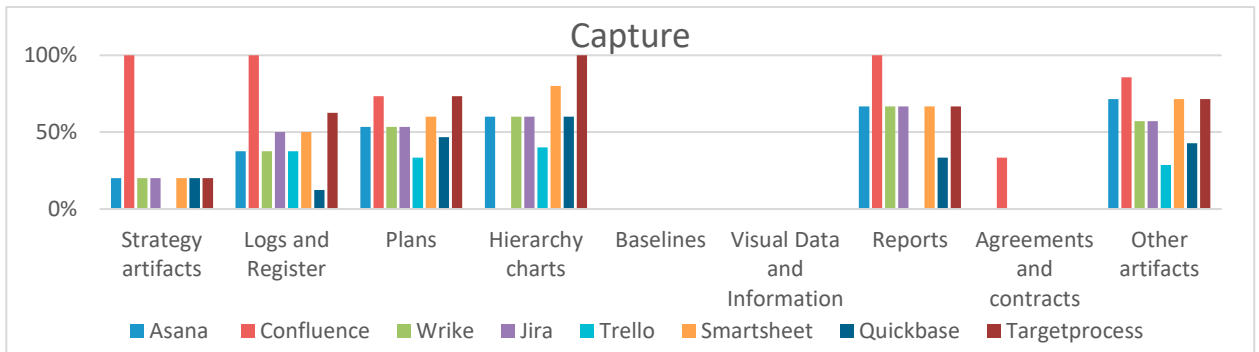
Figure 2: Knowledge Capture capability for the applications, by artifact type.

According to the results presented in Figure 2, it can be verified that Confluence is the application that excels in the majority of artifacts nature for knowledge Capture. In "Hierarchy charts", Targetprocess stands out, as it enables the capture of new knowledge through the five artifacts that make up the category. Concerning the "Baselines" and "Visual Data and Information" category, it was concluded that it was not feasible to capture knowledge through these types of artifacts, and therefore these two categories do not present values for any application. In the category of "Agreements and contracts", only Confluence scored, because it was the only one that presented support to an artifact of this category, namely "Other agreements". Next, Figure 3 is presented, which exposes the results related to the Knowledge Storage process for the different applications, divided by type of artifacts.
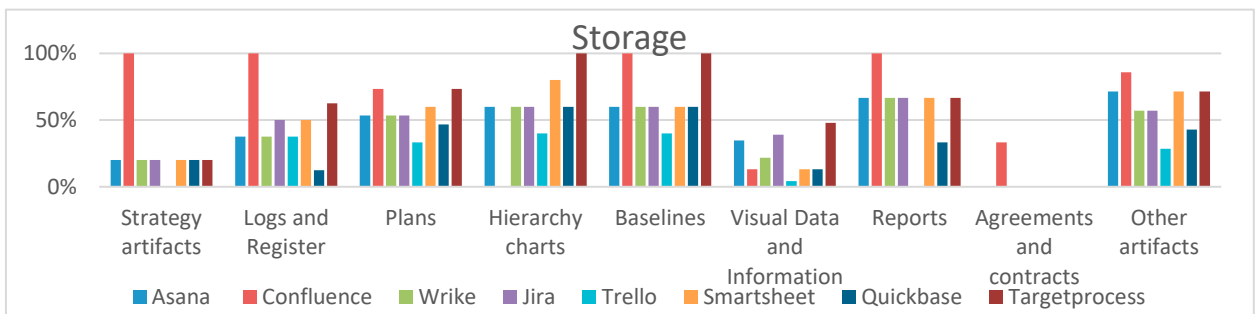

Figure 3: Knowledge Storage capability for the applications, by artifact type.

For Knowledge Storage (Figure 3), Confluence and Targetprocess presented the best results. Confluence stood out in the following categories: "Strategy artifacts", "Logs and Register", "Reports", "Agreements and contracts" and "Other artifacts". In the "Hierarchy charts" category, Targetprocess was the application that provided the best value for this kind of artifacts, supporting knowledge storage through them. As for the "Visual Data and Information" category, Targetprocess was the one that presented the best diversity of data and information presentation artifacts, mainly several types of charts, such as "Cumulative flow diagrams" and "Velocity charts", thus obtaining the best result for knowledge storage in this category. Figure 4 presents the data obtained from Knowledge Sharing.
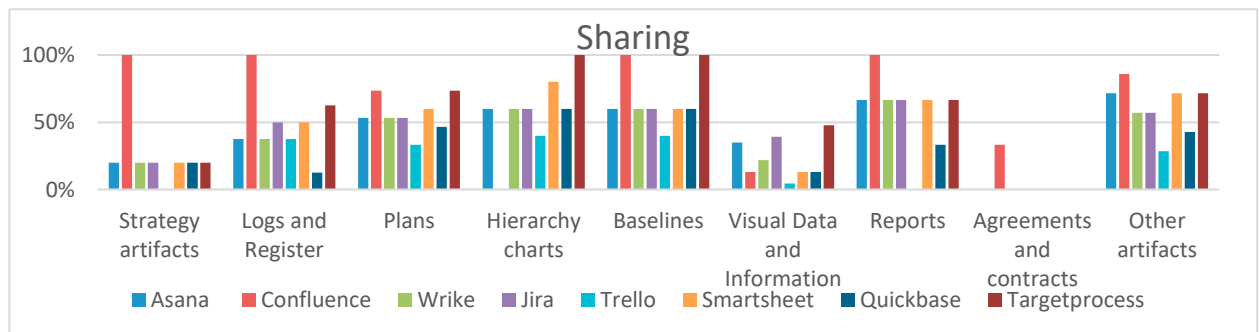

Figure 4: Knowledge Sharing capability for the applications, by artifact type.

In regard to Knowledge Sharing (Figure 4), the results are similar to those of Storage, due to the fact that these two stages are present simultaneously in all artifacts that are supported by the applications, i.e., if there is the capability of storage, then the possibility of sharing that knowledge through the applications is also verified. Again, Confluence presented the greatest capacity to share knowledge compared to most of other categories. In the categorys "Hierarchy charts" and "Visual data and information", Targetprocess was particularly noteworthy. Figure 5 is presented next, with the results concerning the Knowledge Application.
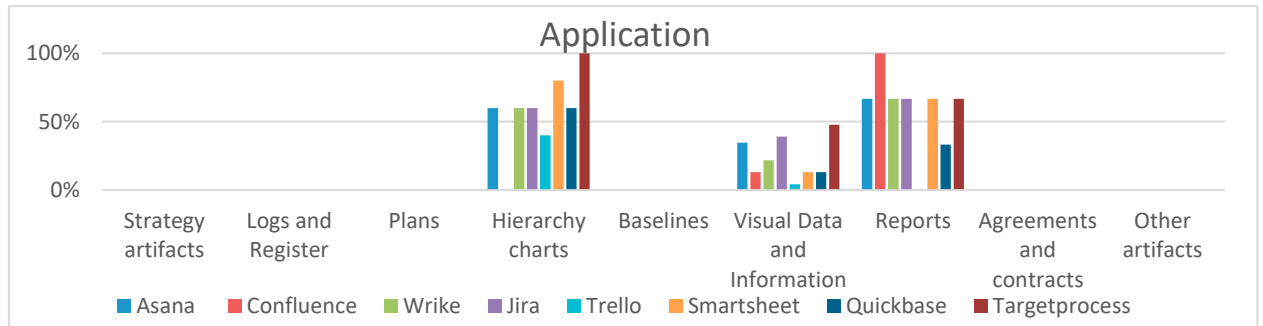

Figure 5: Knowledge Application capability for the applications, by artifact type.

For Knowledge Application (Figure 5), considering that only the artifacts in "Hierarchy charts", "Visual Data and Information" and "Reports" categories enabled knowledge application, the remaining categories presented null values for all applications. However, Targetprocess and Smartsheet can be highlighted for the "Hierarchy charts" category, Targetprocess, Jira and Asana for "Visual Data and Information" category, and Confluence for "Reports" category. Trello presents no values for the last category mentioned, as its free version only has a limited set of features, which makes the platform somewhat limiting in terms of available resources. To use a Gantt chart, for example, it is required to upgrade to Trello Premium.

Table 1: Highest-rated applications for their capability to manage knowledge.

Stages	1st ranked	2nd ranked	3rd ranked
Capture	Confluence	Targetprocess	Smartsheet
Storage	Targetprocess	Confluence	Jira
Sharing	Targetprocess	Confluence	Jira
Application	Targetprocess	Jira	Asana, Wrike

Table 2: Highest-rated applications for each type of PMBOK artifacts (2021).

Category of artifacts	1st ranked	2nd ranked	3rd ranked
Strategy artifacts	Confluence	Asana,Wrike,Jira,Smartsheet,Quickbase,Targetprocess	N/A
Logs and Register	Confluence	Targetprocess	Jira, Smartsheet
Plans	Targetprocess, Confluence	Smartsheet	Asana, Wrike, Jira
Hierarchy charts	Targetprocess	Smartsheet	Asana, Wrike, Jira, Quickbase
Baselines	Confluence, Targetprocess	Asana, Wrike, Jira, Smartsheet, QuickBase	Trello
Visual Data and Information	Targetprocess	Jira	Asana
Reports	Confluence	Asana, Wrike, Jira, Smartsheet,Targetprocess	Quickbase
Agreements and contracts	Confluence	N/A	N/A
Other artifacts	Confluence	Asana,Smartsheet,Targetprocess	Wrike,Jira

The results obtained allow for the classification of the applications based on the knowledge management life cycle and based on the project management artifacts. Based on Table 1 and Table 2, it can be observed the highest-rated applications regarding their capability to manage knowledge and the most suitable applications to handle each type of artifacts, respectively. Regarding Table 2, some applications obtained the same score, and consequently had to be classified at the same level. Other applications do not support a certain type of artifacts, and for this reason, they are not classified. This is the case for the "Agreements and contracts" category, where only one application could be classified (Confluence). Confluence and Targetprocess were the ones that presented the highest score regarding the capability to manage knowledge (Table 1). With respect to the support of PMBOK [1] artifacts, these two were also the ones that presented the highest scores (Table 2). Because these applications stood out, a radial graph is presented according to the capability to manage knowledge, and according to the suitability for each type of artifacts, in order to better compare the profile of these tools. Figure 6 presents the corresponding graphs.
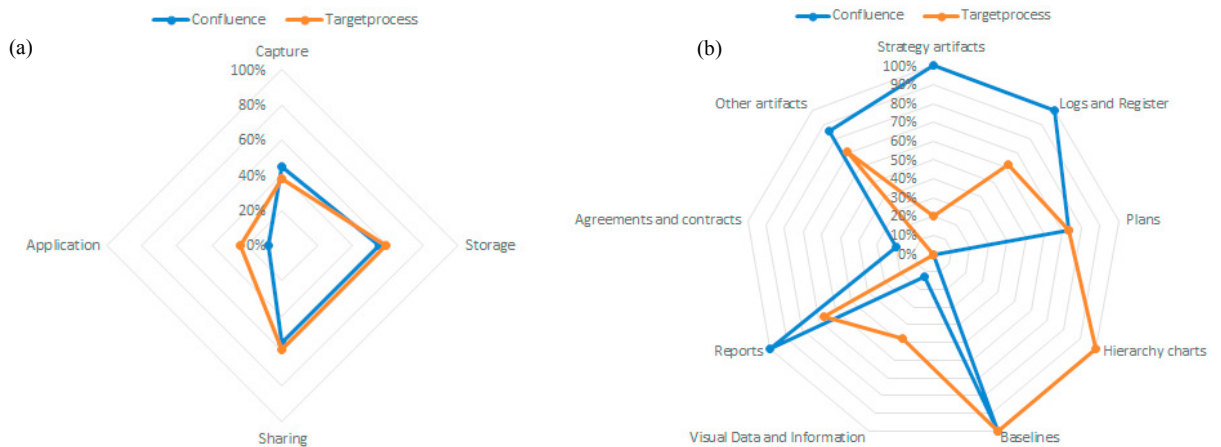

Figure 6: (a) Profile of the top-scoring applications to manage knowledge; (b) Profile of the top-scoring applications to support PMBOK artifacts (2021).

5. Conclusions and future work

By analysing the applications and developing the artifact, it was concluded that through all of these, it is possible to Capture, Store, Share and Apply knowledge, in order to make it explicit, documented and shared within the organisation. All these tools evaluated, enable somehow to manage knowledge, however, certain applications stand out to perform this task. Confluence presented interesting features, it enables the creation of a kind of "knowledge repository", enabling the aggregation of all documentation in the form of templates and artifacts related to the project in a single platform. Furthermore, it allows sharing this content with multiple members, who can edit and comment on the content, providing an exchange of thoughts and experiences between members and teams. All the knowledge generated during the projects can thus be accessible to the whole team and there is also a history of information and changes, which can be reused in future projects of the same nature. This application obtained the best value for the ability to Capture knowledge, having little contribution towards Knowledge Application. On the other hand, Targetprocess and Smartsheet proved to be very useful for managing knowledge in the form of spreadsheets and grids, allowing a large amount of information to be organised and shared in a team environment. Targetprocess obtained the highest score for knowledge Storage, Sharing and Application. Targetprocess and Jira were the applications that presented the best variety of reports and graphical information, supporting several artefacts of this nature such as Dashboards, Cycle time charts or Velocity charts. Quickbase works more as a low-code database, and, therefore, users can build applications to manage processes even without great knowledge about databases. It presented some differences in comparison to the other applications, mainly in terms of menus and features. Trello obtained some null values because its standard version has quite limited features.

Since this analysis focused on the explicit knowledge management capability, it would be opportune to conduct a study in regards to the tacit knowledge, identifying how this type of knowledge generated in the course of projects, can be managed. It would also be interesting to perform a similar analysis, but for the remaining applications not found in Gartner's Leader quadrant, as these applications may have a greater emphasis on features that the Leader quadrant applications scored low on.

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