SPARK Matrix™

Data, Analytics & AI

SPARK Matrix™: Low-Code Application Development Platform, 2021

Market Insights, Competitive Evaluation, and Vendor Rankings

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Quadrant
Knowledge Solutions

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Executive Overview

This research service includes a detailed analysis of global low-code application development platform market dynamics, major trends, vendor landscape, and competitive positioning analysis. The study provides competition analysis and ranking of the leading LCAD platform vendors in the form of the SPARK Matrix. This research provides strategic information for technology vendors to better understand the market supporting their growth strategies and for users to evaluate different vendors' capabilities, competitive differentiation, and market position.

Key Research Findings

Followings are the key research findings:

Market Drivers and Trends:

Considering the impact of Covid-19, Quadrant research has revised the growth estimates and market forecast for the global LCAD platforms market. LCAD platform market is expected to grow significantly in the next five to six years, considering that most industry verticals are focusing on digital transformation and improving customer satisfaction through automated application offering. Quadrant analysts believe that low-code platforms offer agile and collaborative development environments for business users and professional developers. The platform also allows them to design, build, preview, develop, modify, and control applications with a multi-experience development process in real-time.

Globally LCAD platforms market is growing rapidly and estimated to grow more significantly as companies are encouraged to transform their enterprise operations digitally. The primary market drivers of the low-code development platforms are:

- ♦ Digital transformation initiatives across industry verticals as part of the strategy to create digital-first enterprise and achieve operational excellence and business excellence

- ♦ Huge skill gaps pertaining to availability of qualified developer professionals

- ♦ The growing emphasis on providing exceptional customer experience with consistent messaging in an omnichannel environment

- ♦ Growing requirements to offer consistent UI/UX across the web, mobile, tablet and smart devices and accommodate emerging tools for conversational, virtual reality and immersive touchpoints

- ♦ Limitations of legacy applications in meeting the business objective in responding to ongoing market trends and technology disruptions

- ♦ LCAD platforms value proposition of offering functionalities for multi-experience application development without requiring additional efforts.

- ♦ LCAD platform's ability to accelerate time to market for development projects

- ♦ Protect applications from future upgrades and technology disruptions

- ♦ Vendor's strategy in offering use-case specific capabilities for multiple vertical and horizontal use cases

- ♦ Growing adoption of LCAD platforms from a current focus on B2E applications to build B2B and B2C applications

Technology Trends:

The technology investments in 2020 have been significantly impacted by the extended lockdowns imposed by global economies and continued uncertainty around Covid-19. The low-code application development vendors offer a platform that enables users to easily build new business apps and extend or customize existing apps. This platform makes it possible for almost anyone to build web and mobile applications without software development experience. The low-code development platform extended users' ability by offering automation beyond the IT department and allowing anyone from frontline workers to line-of-business employees to build, innovate, maintain, and deliver an application for several uses and automate repetitive and mundane tasks. The LCAD platform market also sees significant growth because of innovative unified low-code automated platform that included pre-built templated, robotic process automation (RPA), artificial intelligence (AI), API integration, and intelligent document processing (IDP), amongst others.

The vendors are also offering advanced Decision Model Notation (DMN) which combines a low-code platform with RAD principles and AI-driven expert systems. Additionally, driven by the promising growth opportunities and growing competition, LCAD vendors are looking at delivering use-case specific or industry-specific capabilities for improved customer ownership experience.

Competition Dynamics & Trends:

Mendix, Appian, OutSystems, Zoho, and Oracle APEX are the top performers in the low-code development platform market and have been positioned as the top five technology leaders in the 2021 SPARK Matrix analysis of the global low-code platform market. These vendors provide a comprehensive technology platform with automated and integrated technology offerings and strong LCAD functionalities to help

organizations promote efficient and rapid application development processes by business users and IT professionals.

The study includes analysis of other major vendors, including AgilePoint, AuraQuantic, Betty Blocks, Caspio, GeneXus, Infor, Kintone, Microsoft, Newgen Software, Oracle, Pega, QuickBase, Quixy, Salesforce, ServiceNow, Skuid, Thinkwise, TrackVia, WaveMaker, and Zudy.

Market Definition and Overview

A Low-code development platform is a visual approach to build an application with little or no code, using virtual interfaces with features like drag and drop, drawing and collating appropriate graphs in certain instances, and employing simple coding methodologies. This can be done by making use of visual development techniques instead of complex coding languages, enabling programmers and non-programmers to design, develop, build, test, deploy and manage such powerful multi-device applications, to create enterprise solutions that drive innovation by connecting all the segments together with minimal technical expertise.

A low-code development platform provides a visual development environment to develop applications and software through graphical configuration and user interfaces. It helps users visually design, create, and automate every step of the application development instead of traditional hand-coded computer programming. A low-code model enables developers and non-developers to create powerful applications with less or no coding knowledge. One of the benefits of the low-code model is that the companies can create an application quickly. However, there is more to low code than just speed. Low code builds the gaps between business needs and the software applications delivered by allowing non-developers to build applications per their specific business requirements.

The low-code development platform enables a no-code feature to design an application like a flowchart with a visual graphical user interface instead of writing line-by-line code. It may also use features like custom coding to allow professional developers to create more complex applications or extend existing applications. This makes developing more powerful and applications quicker and more intuitive. Also, cross-platform accessibility is a major feature that allows low-code platforms to build an application on any device, which can then run on all core platforms and devices.

The low-code application development platform provides additional features like scalability that can handle an increase in user as your business grows and reporting and monitoring workflows that can keep track of process effectiveness. The platform also provides an application lifecycle management that includes several stages in software development such as debugging, testing, and deployment that allow users to create apps with access to upgrade or revert to previous versions if needed for better business outcomes. Finally, the drag-and-drop abilities are established in every low-code platform that enables an easy and convenient development process, one of the most important features for any low-code model through which developers and non-developers benefit.

Quadrant Knowledge Solutions defines low-code application platform as:

"Low-code application development (LCAD) platform empowers citizen developers and professional developers to design, build, test, deploy, and manage enterprise applications without writing complicated code. It includes a visual modelling environment with a graphical user interface enabling business users without a technical background to easily create apps as per their specific business requirements. It may also include functionalities to allow custom coding for professional developers to create custom functionalities, extend existing applications, or build complex applications."

Figure: Low-Code Application Development Platforms
People, Process, Technology, and Strategy Perspectives

People	Process	Technology	Strategy
• The growing emphasis on digital transformation and focus on improving digital customer experience are becoming key differentiators for businesses across industry verticals	• Legacy systems often create operational bottlenecks and slow down the team's efficiencies in responding to market forces and ongoing market trends	• Visual modeling environment with graphical UI for business developers • Functionalities for custom coding for professional developers	• Accelerate digital transformation initiatives • Improving customer experience in an omnichannel environment • Business agility to incorporate the latest trends and implement emerging technologies
• Multi-disciplinary team collaboration and smooth interaction between business users and professional developers on the development projects	• Development projects through professional developer with heavy coding demands long cycle time	• AI-powered smart assistant to offer next-best-step recommendations • Integration with leading cognitive service providers for advanced predictive analytics	• Involve team members to collaborate and contribute to projects • Leverage advanced analytics, process automation, and AI-powered smart assistant to accelerate development projects
• Shortage of qualified developers for meeting business objectives • Lack of communication between the business team and IT often leads to substandard results	• Organizations often face challenges in updating and upgrading applications to accommodate market growth, emerging market trends, and technology disruptions	• Multi-experience capability to support automatic optimization for web, mobile, tablet, and smart devices. • Integration and interoperability with third-party applications and services	• Build a robust team of citizen developers within the organization for various digital transformation projects • Ability to rapidly create new applications and extend existing applications • Protect applications from technology disruptions

Some of the major LCAD functionalities include collaboration, multi-experience development, integration & interoperability, AI-powered assistance, DevSecOps, analytics, and others.

- ♦ **Collaboration:** Several LCAD platforms offers an agile development tool enabling business users and professional developers to work together on the application development project. It may also include multi-disciplinary team collaboration features enabling business stakeholders, partners, and end-users to collaborate on the development projects. Agile collaboration tools add considerable value, especially for large enterprise organizations allowing them to build complex, enterprise-grade applications requiring close collaboration between business users, IT developers, customers, and other stakeholders. The platform's collaboration feature also provides a deep understanding between the business users, IT developers, and stakeholders. With this collaborative environment, the business users can put up the business problem with required initial solutions, while the professional developers can entirely execute the idea into the application to solve the specific business operation need.

- ♦ **Multi-Experience Development**: Leading LCAD platforms to offer multi-experience development features allowing users to design, build, preview, and develop applications for the multi-experience environment, including web, mobile, tablets, and other smart devices. The platform may include functionalities for enabling users to build applications that automatically optimize for the multi-experience environment and allows users to design and preview the applications for each platform separately. The platform may cover developing custom mobile apps, web apps, progressive web apps (PWA), chatbots, virtual assistants, and others. Additionally, the platform also provides an offline working environment that enables the developers to design, build, test, maintain, and control the application development process without an internet facility on different smart devices. This feature also offers a cross-platform up-gradation facility that enables the design of an application on one platform that automatically gets updated into the other device. The sandbox feature of the low-code platform enables users to modify, control, and update the existing application even after the deployment of an application to maintain an application development life cycle.

- ♦ **Integration & Interoperability**: LCAD platform's capability in providing seamless, bi-directional, and out-of-the-box integration with third-party applications and services is essential. Leading vendors may also offer pre-built integration with leading AI services to provide an exceptional experience for building and accelerating enterprise-grade applications at scale. Vendors may also provide details about pre-built connectors, well-documented APIs,

custom connectors, and ecosystem strategies to support the organization's specific software and service infrastructures. This feature of a low-code platform allows developers to use pre-built code and connectors to speed up the application development process. The API Objects allows specifying the API in order to mediate with the customer, separating the implementation from the endpoint options in the integration process. Some of the supported protocols of low-code platforms include REST, gRPC, BPMN2.0, and many more. Additionally, supported web services protocols include REST, SOAP, WSDL, amongst various others to integrate data into the platform.

♦ **AI-Powered Assistance**: While a majority of the leading vendors integrate with multiple AI services to support advanced functionalities, native AI-powered development assistance functionalities are also increasingly becoming an important differentiator. The AI-powered assistance may include a robust recommendation engine to provide bi-directional next-best recommendation for process design, recommendation for interface design, and other development assistance to accelerate application development processes. The platform may also add additional AI bots to further enable better quality and faster development practices. The bots are the latest addition in AI-powered assistance by many low-code vendors into their platform to provide best practices design as well as some other bots for integration assistance. Some low-code application development platform also offers AI-based voice assistance to predict future process and provide a suitable best recommendation for accomplishing the application development process faster.

♦ **DevSecOps**: Product DevSecOps allows to include security into the app development process within the end-to-end SDLC. The technology provides functionalities that enable easy collaborations between the development, security, and operation team. The continuous testing and delivery enable developing and deploying apps faster, with a required security benchmark taken into consideration. It also dramatically reduces analysis time, provides early detection and early remediation, and reduces process bottlenecks, amongst other features. DevSecOps integration into the pipeline requires a new organizational mindset to adopt the technology with the teams and automate security to protect the overall environment and data. It also allows having continuous integration and continuous delivery process that includes security of microservices into the containers. The DevSecOps and providing security to the application development process also offer sets of practices that combine building, testing, monitoring, and deployment of applications with the help of developers and IT operation teams.

♦ **Analytics**: The analytical capability of a low-code environment allows easy access to information that ranges from connection to visualization and analysis of data. It also enables democratizing information and empowering people who do not have high technical or statistical knowledge to analyze information more effectively. The data visualization feature offers visual analytics, KPIs, and interactive dashboards. The automated reporting offering provides predictive analysis mechanisms and the decision to support different types of data analysis for the low-code development platform. The platform may also offer a (GUI) Graphical User Interface connected with AI programs, AI integrators, AI application manager that offers troubleshooting facilities to the platform, amongst others. The analytics feature also allows viewing real-time business insights for rapid decision making, along with automating data stories, creating AI and microservices in minutes, improve business agility - which is some of the other capabilities that a low-code platform offers to improve best cross-platform mobility providing a high 'time-to-value ratio to the business.

Low-Code as a Business Transformation Strategy for the Enterprise

The enterprise application development platform, which has been recently modified, offers a strategic approach with a high level of functionality in the application development process. The enterprise-grade low-code application development model divides the organization's users into three categories that are: the UI generation software which enables the designer to build the user interface software based on designs, the Integration software, which allows users to create a connection between software applications in the enterprise environment and allow to move data through those connections. And finally, transformation software enables the users to create applications with the help of machine learning and RPA technology. The primary function of this software is to add value to data as it moves between applications.

Choosing a Right Low-Code Platform

If the enterprises are looking for an application with continuous innovations, choosing a low-code platform that offers secure, scalable, and sustainable citizen development capabilities are recommended. If the enterprises required an application that would be faster than the previous one, then it should aim at the low-code platform that accelerates the rate at which developers deliver applications to the end-users, with minimal design and deployment time. Additionally, if the enterprises choose to prioritize the speed of the development process using a low-code platform for business developers, the enterprise should find a platform that also offers robust data management, reporting and collaboration, and governance and security along with quick design and deployment options.

Low-Code Strategy for Business Transformation

♦ **Contemplate Low-Code as a Business Strategy**: The business users need to identify the business problem for which a solution is required, then take concerns of the stakeholders and professional teams to provide ideas and deadlines for the application to meet key business needs.

♦ **Solve Focused Challenges**: To transform the business, the enterprise should solve focused challenges, within an organization, there are challenges in every department or the group. Initially, the enterprise should aim to solve simple non-integrated scope where there is no risk of exposure of overly sensitive information.

♦ **Recognize and Support the Business Users**: The business users are the one who is subject matter experts, operational leaders, with the right skills to solve everyday business challenges. The platform offers flexibility by outlining the

roles and responsibilities for individual stakeholders after identifying the appropriate skills and knowledge required to develop an application.

♦ **Rebroadcast Applications**: The enterprise needs to work on multiple feedback sessions and then deliver configuration via mock-ups, logic sessions, working prototype, and others, to show how the application operates and get immediate field feedback.

♦ **Obtain Technical Prospects**: Most business users are not technical builders; hence they require IT team assistance and guidance to develop apps. For complex application business users must collaborate with IT team for successful development of applications.

♦ **Robust Application and Data Security**: The IT team can build governance for all kinds of applications to protect sensitive data, performance, and security policy in the integration process.

♦ **Pick up a Scalable Platform**: The enterprise needs to choose a vendor that offers a uniform platform with use cases, skill sets, and an environment that is required to scale the application for the digital transformation.

Risks and Challenges of Creating Application by Business Users

♦ **Shadow IT:** While the user can use shadow IT to complete their task, the technology introduces unprecedented risks like lost control and visibility, lost data, system inefficiencies, cost, non-compliances, and unknown expansion of attack surfaces, amongst others. The enterprise can collaborate and educate the business users, streamline governance, use on-premises web filtering and configuration management database are some of the technologies that can help reduce shadow IT practice.

♦ **Complex Development and Customization**: Business users find it challenging to customize apps on the low-code platform as they have minimum or no programming knowledge. Some applications are made in minutes with a point-and-click interface, but some require coding and hours to develop if requires hand-coding. The IT persons should assist in coping up with complex customization processes and provide one-time training to achieve a successful, repeatable application.

♦ **Vendor Lock-ins**: Some vendors offer low-code functionalities using open code and open framework, which can be standard code that works from anywhere and other vendors platform. While selecting an appropriate low-code platform, users should collaborate and communicate the requirements with the IT team to understand vendor lock-in policies and similar other details.

♦ **Integration Risks**: As community developers make use of low-code application development platforms, they run the risk of exposing potential sensitive data to different internal enterprise systems and external APIs, making the data vulnerable. Hence, the developers should place an appropriate control on the content utilized for development and integration, and what happens to the data during the processing, in order to manage the risk associated with integration.

♦ **Data Transformation Risks**: The business user not only reads, writes, and integrates the internal system with an external system but also performs data transformation within the low-code platform. The enterprise should build an expert machine learning and data transformation team to offer access and control over data and provide business users when they need it.

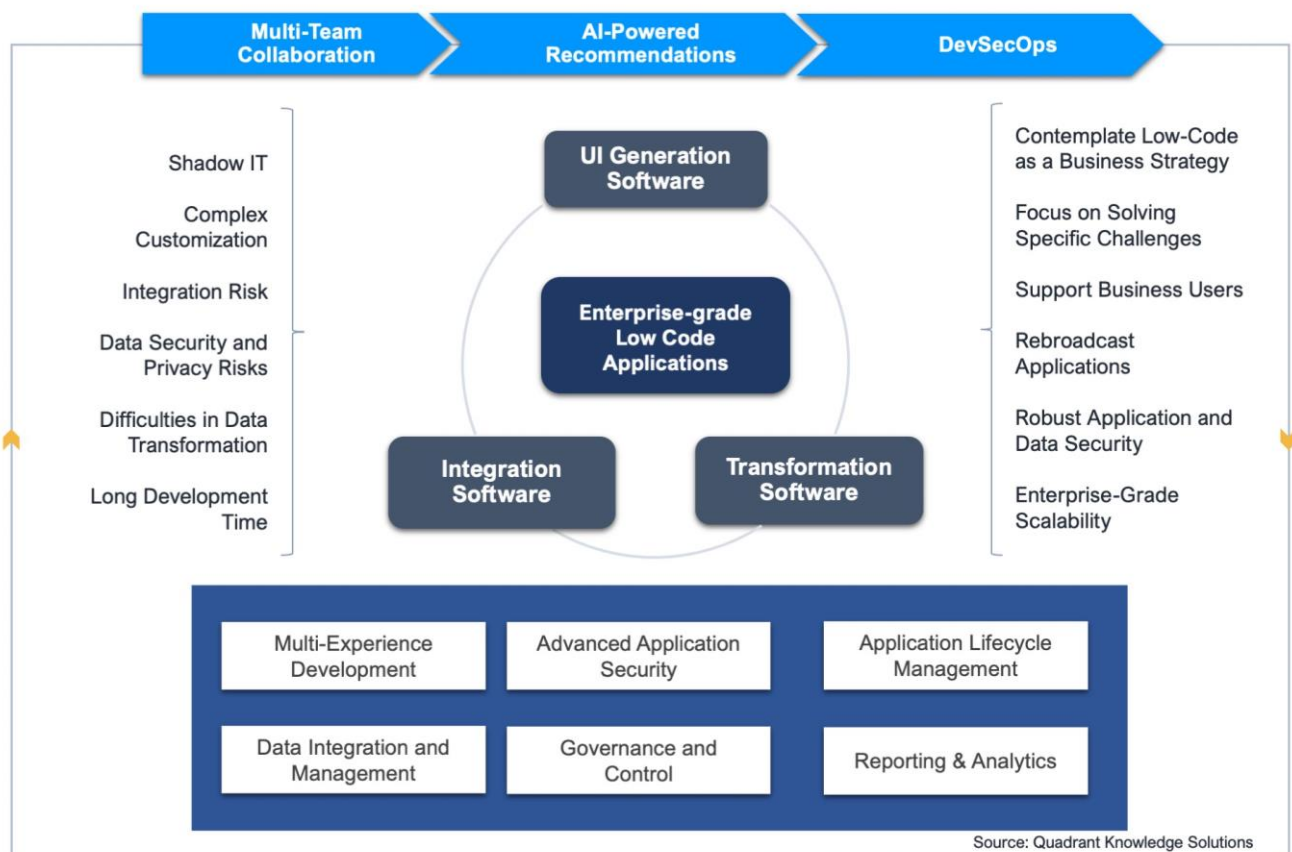**Figure: Low-Code as a Business Transformation Strategy for the Enterprise**

Figure: Low-Code as a Business Transformation Strategy for the Enterprise

Primary Use Cases of a Low-Code Application Development Platform

In this modern era, the technologies have changed; the new generation of low-code platforms are self-contained than previous technologies. The early Rapid Application Development (RAD) evolved in drag-and-drop tools, graphical models, server architecture, and integrated low-code environment. The vendors are also offering advanced Decision Model Notation (DMN) which combines a low-code platform with RAD principles and AI-driven expert systems. Other than application development, simplified integration also enables non-technical developers to create integration with use case as Integration SaaS (iSaaS).

Figure: Primary Use Cases of Low-Code Application Development Platform
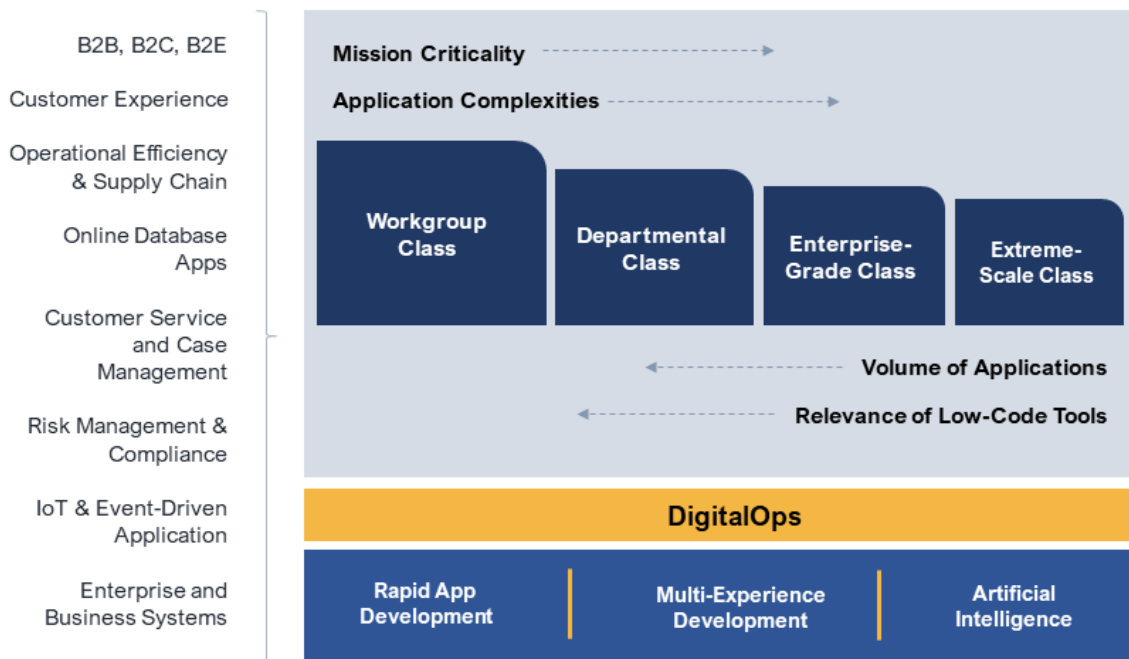
Figure: Primary Use Cases of Low Code Application Development Platforms

How Low-Code Platforms are Helping Users in Building Various Types of Applications

Low-code application development evolution occurs with the significant emergence of web applications. Some of the other technology vendors offer low-code application development platforms to minimize IT developers' involvement in the applications deployment process, hence providing automated cloud offerings. On the other hand,

PaaS vendors allow developers to customize and extend their platform to build a new, complex enterprise applications.

Developers sprang up to exploit the low-code development technology extensively in recent days. This becomes a part of the digital workplace charter supporting the workgroup class, departmental class, and enterprise-level class application development. The applications that come under extreme scale class which required professional IT involvements are out of low-code capabilities for application development.

A low-code application development platform is invented to build the gaps between business needs and provide business solutions. Further, low-code development for mobile apps used in the workplace under rapid mobile app development (RMAD) tools. Additionally, the LCAD platform empowers business users and the IT teams to deliver digital products holistically and collaboratively, eliminating shadow IT for present and future business needs.

Primary Use Cases

♦ **B2C, B2B, and B2E Applications (Customer, Business, Employee)**: There is a difference between B2C, B2B, and B2E applications- B2C applications are widely used by the general public. B2B applications were developed to fulfill the needs of the industry or to streamline complex operations. B2E allows companies to provide products and services to their employees using an intra-business network.

♦ **Customer Experience**: To increase customer loyalty and customer satisfaction, customer experience application provides a holistic perception of their experience with your brand or business. Leading low-code platforms vendors have demonstrated their success stories where several leading organizations have built applications for customer experience use cases.

♦ **Operational Efficiency and Supply Chain Management**: The operational efficiency of an organization expounds as the ratio between the output gained from the business and input to run a business. Several industrial organizations are using low-code platforms to build applications for operational efficiency and supply chain management use cases.

♦ **Online Database Application**: In terms of user adoption, customers use the LCAD platform to build simple online database applications. These are typical Excel, MS Access-based operations converted to a cloud-based, shared repository on the vendor platform.

♦ **Customer Service and Case Management**: Customer service and case management allow companies to reach optimal results for clients. Any interaction with a customer is the use case, usually an individual customer. It plays a vital role in the business workflow as companies shift towards a more customer-focused landscape.

♦ **Risk Management and Compliance**: Most low-code development application platforms provide compliance control, policy management effectiveness, and risk management transparency. Enterprises are still exploring on building applications to manage business and operational risk and automating their compliance processes.

♦ **IoT and Event-Driven Applications**: A small percentage of LCAD customers are also making use of the platform to create business-critical systems that collect IoT events from various sensors and manage millions of events per year.

♦ **Modernization of Legacy Systems**: Interactive dashboards and easy-to-design custom reports has been put to good use by their customers to integrate with their legacy application systems and gain more out of their IT ecosystem. Many vendors are focusing on building custom applications that neatly fill the gap in the existing system, increase the overall efficiency of those legacy systems.

♦ **Enterprise and Business Systems**: Low-Code platform's market is still in the emerging stage to address use cases for building enterprise and business systems. These applications are highly complex and require enterprise-grade scalability. However, leading low-code vendors are continuously improving their platform's capabilities to address these challenges.

♦ **Industry-specific use cases**: With the rising demand for low-code applications, enterprises are beginning to realize long-term benefits and makeshift in using low-code platforms. Businesses required a quick app-based solution to satisfy their industry-specific business needs.

Impact of Covid and Dynamics of Low-Code market

When considering the unprecedented impact of the COVID-19 outbreak, the previously digitalized businesses were able to gain the advantage in handling this situation. Developing a custom application requires expensive software developers and a typical development cycle that takes few months to complete the application while procuring ready-to-use COTS creates application silos, and this software does not seamlessly integrate with other IT applications with the enterprise. The demand for low-code and no-code has risen dramatically during the COVID-19 pandemic. The low-code application development platform provides endless possibilities to the organization as it can innovate faster and solve day-to-day business issues by the collaborative efforts of business users and IT professionals.

Obstacles Faced by the Organizations to Get Success in the Time of the Pandemic.

The organizations face several challenges in the time of the pandemic, which include shifting some of the business processes, nearly every industry has to alter in their delivery of products and services. The organizations have been forced to work remotely by supporting the work home model. This introduces new connectivity, security, and management challenges that require skill sets, connectivity, and equipment to fully operate working remotely. Managing remote IT staff is one of the critical challenges an organization faces, which can be solved by establishing a remote communications protocol. Shifting to organization-wide virtual collaboration enables people to collaborate from remote locations with technologies like chats, video conferencing, and many other platforms.

Business User Obstacles

When a need for a new app is required for a project, the business users should know all the platform's offerings to meet the project requirements. Low-code platform also introduces bloating effects to the codebase that ultimately slows down the app and prevents users from working with large datasets. Business users need to surpass the learning curve of a proprietary low-code tool. The users need to learn some of the business logic like TypeScript, JavaScript, Node.js, which enables them to get complete advantage of the low-code platforms along with the visual tools. The low-code platform focuses on designing apps with intuitive visual drag and drop features, but when it comes to designing a complex enterprise application, the business users need to write code that they are not familiar with. Pulling out data from a low-code platform to a local database cause difficulty for the business users.

IT Team Obstacles

With the increase in digital transformation, the demand for advanced technology is increasing, which puts immense pressure on the IT teams to rapidly deliver the application to meet business requirements. Both groups, the business users and the IT developers, agree that faster development tools are one of the solutions to rapidly deliver apps, followed by more availability of specialized skilled labor for coding across multiple technologies and platforms. The perception that the IT team cannot meet organizations' demands, not able to perform due to less power leads to creating unsatisfied job roles, uncertainty, and hesitation. Moving legacy systems to the cloud and merging new apps into existing workflows is not simple. The problem is that legacy apps were written years or decades ago to fit old architectures that are now obsolete.

Improving Business Outcomes and Job Satisfaction with Low-Code Platform

The digital transformation in the organization is reaching deeper with the technology offerings such as AI, RPA, and other emerging platforms to automate manual processes and workflows. The increase in demand for specific use cases by the organization's increases pressure on the IT teams causes a low level of job satisfaction. The low-code application development platform enables to replacement of the coding with the visual designing platform. The platform also offers automated application development that is easy to create, integrate, update and provide continuous maintenance for faster delivery of enterprise applications. Hence, the platform automated feature allows developers to invest their time in higher-level projects, which provides developer's greater business and personal rewards.

Some of the value proposition of low-code platforms to improve business outcomes:

♦ **Efficiently Responding to Business Needs by Reducing IT Backlogs**: The IT teams can quickly respond and provide solutions requested by developers in the application development stage with the low-code platform.

♦ **Empower Organizations to Solve Challenges**: With the low-code, platform organizations can accelerate the democratization of app development and empower employees to create their own solutions quickly.

♦ **More Output with Less Input**: The organization has limited resources to spend on traditional costly application development methods. Additionally, when app development becomes much faster and more efficient, even for niche use cases platform can become worthwhile and extremely valuable.

♦ **Automate Time-Consuming and Manual Business Processes**: The LCAD platform provides an AI-assisted low-code app platform to work closely with the core apps of the organization, and hence it also enables to easily increase productivity by automating mundane, time-consuming business processes into streamlined workflows.

♦ **Run Across Different Platforms**: Most workers want to use applications anywhere, on any device. Building these types of multi-device, cross-platform experiences from scratch can be challenging, but the rewards can be significant.

♦ **Maintain Security and Controls**: The solutions created in several low-code platforms are secure because they exist within the regulation compliant. Environments can be incorporated as a way to create boundaries for different security needs. This makes it easy to ensure compliance by grouping apps with similar security requirements.

Competitive Landscape and Analysis

Quadrant Knowledge Solutions conducted an in-depth analysis of the major Low-Code Application Development Platform vendors by evaluating their products, market presence, and value proposition. The evaluation is based on primary research with expert interviews, analysis of use cases, and Quadrant's internal analysis of the overall Low-Code Application Development Platform market. This study includes analysis of key vendors including AgilePoint, Appian, AuraQuantic, Betty Blocks, Caspio, GeneXus, Infor, Kintone, Mendix, Microsoft, Newgen Software, Oracle, OutSystems, Pega, QuickBase, Quixy, Salesforce, ServiceNow, Skuid, Thinkwise, TrackVia, WaveMaker, Zoho and Zudy.

The low-code platforms market consists of a wide variety of a well-established as well as emerging vendors. The market consists of different vendors that have a strong presence in other market categories, including the intelligent BPMS (iBPMS), mobile app development, multi-experience development, CRM and other SaaS applications for marketing, database management, content management, and other markets. Driven by the promising business opportunities and market growth, emerging vendors are continuously entering into the LCAD platforms market each year.

The low-code application development platform market has shown tremendous growth with capabilities offerings such as DevSecOps, AI tools, machine learning tools, robotic process automation (RPA), business process management suits (BPM), intuitive drag-and-drop features, multi-experience development, and many others. The LCAD platform allows SMB to large-sized organizations to design, test, maintain, and deploy web-based applications quickly, followed by progressive web apps (PWA), native mobile applications, and applications that can run on several smart devices. The LCAD platform has been enormously used by the financial service and banking sector, followed by the government & public sector, healthcare & life science, manufacturing, and logistics industry sectors. Additionally, fusion team offering promotes employee experience and a sense of ownership in the application development process.

Mendix, Appian, OutSystems, Zoho, and Oracle APEX are the top performers in the low-code development platform market and have been positioned as the top five technology leaders.

Mendix offers AI-Assist performance bot and AI-assist logic bots to provide developers with real-time support in building their applications model and business logic. Additionally, Mendix LCDP enables seamless transition across channels/ touchpoints integrated with existing cloud services in the organization. Appian's LCDP offering includes its unified platform offering, which provides a comprehensive set of low-code

automation capabilities within a single license; it has the ability to serve as an enterprise standard platform across use cases and for all app complexities.

OutSystems platform provides robust embedded BPM functionalities to support organizations in building the entire portfolio of business-process-driven applications. OutSystems supports building or modernizing enterprise-grade apps for B2B, B2C, and B2E environments. Zoho's LCAD platform offering includes a unified data model to patch solutions together from disparate applications, systems, and technology stacks to make the system work. AI capabilities can be accessed through both the drag-and-drop builder as well as through programming custom Deluge tasks.

Oracle APEX's LCDP offerings include a metadata-driven application for which the data is stored in database tables and used to create, extend, and modify the application without a code generator. Microsoft Power Platform offerings include building high tailored applications with Power App Canvas. It also enables the creation of apps for any device that uses a wide variety of controls, including cameras and location, or start from a sample app showcasing common business scenarios, like expense reporting or site inspections.

GeneXus also has a robust offering in programming languages, databases, integration methods, and experience of languages, markets, industries, and territories in the areas of security, integration, and design, amongst others. Also, GeneXus, with its new technology like artificial intelligence-powered platform, is designed to easily incorporate applications with its high-speed offering.

Infor Mongoose's LCDP offerings include a personalization application development process that enables customers to add their changes to forms, and the sync engine will automatically take their unique changes and merge them with the new base forms. Oracle Visual Builder's LCAD platform offering includes an easy extension of Oracle applications via Oracle native SSO and identity propagation with Oracle SaaS services. The platform offers web, native mobile, and PWA options using a single source code base.

WaveMaker's LCDP offerings include the auto generation of Java code and JavaScript for the complete application stack. The open standards-based platform enables professional developers to own, extend and customize their code, while offering the flexibility of deployment to any infrastructure of choice. Zudy low-code Vinyl platform allows full stack developers and citizen developers to rapidly design, test, and release a secured application that can be extended easily. TrackVia's LCAD platform offering includes code optional features that allow users to build enterprise-grade workflow apps entirely with a drag-and-drop interface while also providing the option to add custom code if required.

The SPARK Matrix analysis recognizes Salesforce, ServiceNow, Pega, Caspio, and Betty Blocks as a major challenger in the global low-code development platforms market. Vendors such as QuickBase, Skuid, Quixy, Kintone, Thinkwise, Newgen, AuraQuantic, and AgilePoint.

The low-code application development platform market indeed has a number of strong contenders and is expected to have an even more intense race for maintaining the lead in the near future. With continuously evolving global technology scenarios, faster adoption rates, and compelling developments happening round the clock, the vendors need to also keep up with the evolving requirements and business needs. The current pandemic situation and how it has changed the perception & application development patterns of millions of employees worldwide. Low-code application development platform vendors must also brainstorm and continuously innovate to try and come up with solutions that make these changing & sometimes challenging working environments more productive & less stress-free for the users. Ultimately, any solution that eases the burden of employees and increases their productivity always brings the maximum value to the table; hence the vendors could make the best use of the current situation for innovating & establishing themselves further.

Competitive Differentiators

While most LCAD platform vendors provide comprehensive functionalities to support various use cases, their technology and customer value proposition may differ based on the customer size, industry vertical, geographical markets, and organization-specific requirements. The digital environment is continuously transforming, requiring vendors to expand their R&D budget and make continuous enhancements to their platform's value proposition to ensure future market needs. Users should look for partnering with low-code platform vendors with robust technology strategy and roadmap for enhancing their platform features & functionalities, product strategy, and alignment with emerging transformational trends. The vendor's ability to accommodate emerging technology trends, including artificial intelligence, machine learning, cognitive operations, and truly open & unified platform is increasingly becoming key differentiators for the selection of low-code application development platforms and solutions. Some of the key competitive factors and technology differentiators for the LCAD platform include:

♦ **Unified Low-Code Automation Platform**: The unified low-code automation platform allows IT teams to deliver rapid and significant business values with scalable enterprise automation technologies that include low-code robotic process automation (RPA), artificial intelligence (AI), API integration, workflow platforms, intelligent document processing (IDP), case management, analytics, pre-built services, and decision rules, among others. With the release of a unified automation platform, the application development process has become smarter, faster, and more resilient, defining a new world of hyper-automation. Technology such as Rapid process and task automation with low-code allows recording processes and turning them into bots. It also allows creating bots that interact with websites and cloud services easily in low-code development platforms. The native intelligent document processing (IDP) offering of a low-code platform allows to automate forms and manual tasks and also use AI services to convert unstructured data into structured data without any human intervention. The platform's API integration allows collecting data from connected resources that can quickly integrate and build mobile and web platforms without migrating data. The analytics features such as the application health dashboard monitor the application performance and notify security alerts to the developers. It also provides recommendations to solve design issues and gain intelligent design improvements. Hence, the release of unified low-code automation technology enables the developers to create, test, maintain, and deploy applications faster, automating the whole business operation.

♦ **Multi-Persona App Development with Fusion Team**: The low-code platform providers enable a deep set of capabilities or supporting collaborative development between professional and citizen developers that includes - low- and no-code design platform, AI-assisted development, built-in design recommendations, enabling citizen developers to use governance features, pre-built app templates, training programs, and providing DevSecOps guardrails, amongst various others. The features such as no-code and low-code design within the platform allow the citizen developers to design and create based on intuitive visual drag-and-drop features, while it also enables the professional developers to write code for building complex enterprise applications. The AI-assisted development environment and pre-built templates, and built-in design recommendations allow developers to create applications faster. Some companies also provide manual training to the developers by assigning a customer relationship manager to provide training on the new technology. DevSecOps automation feature allows continuous integration and continuous delivery, enabling teams to accelerate software innovation while simultaneously maintaining security and governance controls.

♦ **Enterprise-Grade Application Development Platform**: The low-code vendors provide an enterprise-grade application development platform that includes features like cloud availability, scalability, robust security, automatic upgrades & support for the latest- experiences, interactions, devices, and others. It also provides capabilities such as extensibility, DevSecOps, and application lifecycle management. An enterprise-grade application utilizes multi-users, multi-developer, and multi-components features that can work on a large scale of data and can be secured and deployed on multiple platforms with ease. An enterprise application is business-oriented, developed and deployed to meet the demands of the end-users by understanding and incorporating the needs of the internal business team and external stakeholders of the company. The platform offers automatic up-gradation and scaling to the application when required by the company. The platform also supports AI interactions, built-in experiences, analytics, and multi-device offerings for creating, building, testing, and maintaining the overall application development lifecycle. The platform's easy to upgrade feature allows to automatically upgrade and manage all operational responsibilities.

♦ **Full-Spectrum Development & Flexible Deployment**: A comprehensive low-code application development platform brings simplicity to the most challenging and complex areas of app development regardless of the type, experience, and use cases associated with the apps. A single platform can be used to create- mobile apps, offline mobile/field service apps, omnichannel B2C customer engagement apps, conversational apps, self-service customer

portals, apps requiring IoT integration, core systems modernization, front-office employee apps, back-office employee apps, apps requiring AR/MR integration, and such others. For full-spectrum development, the developers need to implement the latest designs and trends to frameworks for creating services that can be scaled up and back again - based on demand, which will enhance the user experience. It also enables to focus on security throughout the development lifecycle by providing tools that can provide quick feedbacks and diagnose the security vulnerabilities while writing code in the platform. The low-code platform enables professional development teams to build applications faster and gives them the flexibility to host apps on any cloud, such as on-premises, public cloud, private cloud, and hybrid cloud infrastructure. This feature also enables the user to be free from all kinds of code lock-in, such that they are free to export and transfer their code to any other platform if required.

♦ **Maturity of AI-Specific Capabilities**: User should look for the maturity of the AI-powered assistant capabilities to help business users and developers in providing next-best recommendations for process design, interface design, and other development assistance to accelerate application development processes. Additionally, the integration with leading AI and machine learning services is important for enterprise-grade applications.

♦ **Protection Against Technology Disruption**: Users should evaluate the impact of technology disruption over the years on various programming language, commercial-off-the-shelf and SaaS applications, and applications developed using low-code platforms. Protection against technology disruption is amongst the major differentiators for selecting low-code platforms versus SaaS applications for several use cases.

♦ **Vendor's Strategy and Roadmap**: The low-code platforms enable the integration of data anywhere, from multiple open platforms, that enhances existing systems and allows customers to leverage best-of-breed technologies that can be invoked as part of an automation process. The customers do not have to migrate data to use across enterprises siloed systems but allow to bring data into a single UI for end-users and enabling them to take action and execute business processes. The differentiating technology that allows customers to do this is no-code integration capabilities in a low-code design object inside the platform that serves as a composite UI of data from multiple systems. The future-proof technology of low-code platform allows independent & multi-platform development investments that can be preserved through time, no matter how technology changes or how the system needs to be adapted to attend future business realities. The platform also offers a developers-based pricing feature. The companies do not get charged by the

final user count that operates the platform but rather on a single developer licensing seat basis. Additionally, it also provides developers tools with no runtime fees. The platform enables businesses to create a number of user-generated applications without the fear of lock-in into the environment. Clients are relieved from additional costs when creating new apps becomes necessary or when the apps become more popular and successful. The platform's integration with artificial intelligence provides real-time support and the next-best recommendations to developers in building their application models and business logic.

Market Direction for LCAD Platform

Low-code development platform has been gaining a lot of traction with digital transformation and emerging technologies, industrial automation, and enhancing the customer and user experience. The low-code platform provides a seamless application development lifecycle with its DevOps feature offerings. The platform enables designing, building, deploying, testing, and maintaining the entire app development process quicker. The platform also enables developers to iterate and prototype applications with ease. The low-code development approach benefits the professional developers and business users who are willing to build robust applications without any formal training. With the increasing demand for enterprise applications and digital transformation, the low-code platform has the ability to support business requirements. In such a case, it becomes imperative for the global low-code vendors to understand the pulse of the current market and estimate the future requirements well in advance.

The low-code platform provides innovative, economical, and path-breaking ways of application development that can revolutionize any organization's tech capabilities. The low-code development vendors focus on offering attributes such as pre-built templates, codes, connectors, and generators into their platforms. With the technology advancement, the low-code vendors also focus on providing unified low-code platform automation by integrating robotic process automation, artificial intelligence, machine learning, private/ public/ hybrid deployment options, intuitive visual interfaces, and out-of-the-box integration. These toolkits and integrated features allow developers to cross-collaborate with organizations' stakeholders for faster decision-making, improve productivity exceptionally, and provide unparalleled time-to-value in the application development process.

Moving forward, the low-code application platform solutions offer agility that enables the business to quickly respond to ever-evolving customers and business needs. It also paves the way for building maintainable solutions that can be easily scaled using cloud-native architecture. Additionally, the vendors offer a low-code platform that enables the users to feel a sense of ownership and speed up the end-to-end development process with total customizations feature available for both simple and complex applications. It also provides a next-gen rapid application development tool for professional developers. The low-code vendors continue to focus on providing a vast variety of application development solutions and deployment options such as customer engagement apps, AI-based solutions, optimization apps, modernization of legacy systems, case management, innovative apps, and industry use cases solutions, amongst various others.

On the other hand, vendors are also focusing on implementing new innovative technologies into their platforms to meet business and customers' requirements.

These roadmaps include transformation from DevOps to DesignOps to offer more cross-UI frameworks such as React and Vue into the low-code visual interface platform, API technology with security integration such as OATH 2.0 and SAML 2.0, updated DevOps CI/CD to ensure a continuous delivery pipeline with new testing and deployment capabilities. Additionally, the companies also continue to deliver more complex B2C, B2B, and B2E experiences through expanding user experience with other touchpoints such as AR/VR. The AppDev solutions for process integration and delivering digital transformation initiatives for applications to operate outside of their siloes and communicate with the business needs again stand out as an advance roadmap by the vendors. Similarly, the low-code platform offers modern architecture with best practice and microservices offerings for the developers and democratizing application development across different developer personas to create innovative apps. Finally, the companies are moving towards offering hyper-automation, distributed cloud offerings, AI governance and security, extended edge, and extended reality into their platforms in coming years.

The low-code platform technology vendors are working towards offering digital transformation by integrating automation process into their platform, which includes intelligence business process management suits, multi-experience development platform (MDXP), robotic process automation (RPA), citizen automation, and development platform (CADP), Decision model notations (DMN), AI assistance and next-best actions recommendations amongst various others to increase the rate of delivery of applications into the market. The low-code application development platform market is poised to grow at an increasing rate, especially in the wake of the pandemic situation, wherein the organizations would tend to rely more on these vendors for support and to lessen their own burden of the cumbersome of application development activities, to stay ahead in the curve in the future times to come.

SPARK Matrix™: Strategic Performance Assessment and Ranking

Quadrant Knowledge Solutions' SPARK Matrix provides a snapshot of the market positioning of the key market participants. SPARK Matrix provides a visual representation of market participants and provides strategic insights on how each supplier ranks related to their competitors, concerning various performance parameters based on the category of technology excellence and customer impact. Quadrant's Competitive Landscape Analysis is a useful planning guide for strategic decision making, such as finding M&A prospects, partnership, geographical expansion, portfolio expansion, and similar others.

Each market participants are analyzed against several parameters of Technology Excellence and Customer Impact. In each of the parameters (see charts), an index is assigned to each supplier from 1 (lowest) to 10 (highest). These ratings are designated to each market participant based on the research findings. Based on the individual participant ratings, X and Y coordinate values are calculated. These coordinates are finally used to make SPARK Matrix.

Technology Excellence	Weightage
Sophistication of Technology	20%
Competitive Differentiation Strategy	20%
Application Diversity	15%
Scalability	15%
Integration & Interoperability	15%
Vision & Roadmap	15%

Customer Impact	Weightage
Product Strategy & Performance	20%
Market Presence	20%
Proven Record	15%
Ease of Deployment & Use	15%
Customer Service Excellence	15%
Unique Value Proposition	15%

Evaluation Criteria: Technology Excellence

♦ **The sophistication of Technology**: The ability to provide comprehensive functional capabilities and product features, technology innovations, product/platform architecture, and such others

♦ **Competitive Differentiation Strategy**: The ability to differentiate from competitors through functional capabilities and/or innovations and/or GTM strategy, customer value proposition, and such others.

♦ **Application Diversity**: The ability to demonstrate product deployment for a range of industry verticals and/or multiple use cases.

♦ **Scalability**: The ability to demonstrate that the solution supports enterprise-grade scalability along with customer case examples.

♦ **Integration & Interoperability**: The ability to offer product and technology platform that supports integration with multiple best-of-breed technologies, provides prebuilt out-of-the-box integrations, and open API support and services.

♦ **Vision & Roadmap**: Evaluation of the vendor's product strategy and roadmap with the analysis of key planned enhancements to offer superior products/technology and improve the customer ownership experience.

Evaluation Criteria: Customer Impact

♦ **Product Strategy & Performance**: Evaluation of multiple aspects of product strategy and performance in terms of product availability, price to performance ratio, excellence in GTM strategy, and other product-specific parameters.

♦ **Market Presence**: The ability to demonstrate revenue, client base, and market growth along with a presence in various geographical regions and industry verticals.

♦ **Proven Record**: Evaluation of the existing client base from SMB, mid-market and large enterprise segment, growth rate, and analysis of the customer case studies.

♦ **Ease of Deployment & Use**: The ability to provide superior deployment experience to clients supporting flexible deployment or demonstrate superior purchase, implementation, and usage experience. Additionally, vendors' products are analyzed to offer a user-friendly UI and ownership experience.

♦ **Customer Service Excellence**: The ability to demonstrate vendors capability to provide a range of professional services from consulting, training, and support. Additionally, the company's service partner strategy or system integration capability across geographical regions is also considered.

♦ **Unique Value Proposition**: The ability to demonstrate unique differentiators driven by ongoing industry trends, industry convergence, technology innovation, and such others.

SPARK Matrix™: Low-Code Application Development Platform Market
Strategic Performance Assessment and Ranking

Figure: 2021 SPARK Matrix™
(Strategic Performance Assessment and Ranking)
Low-Code Application Development Platform Market

SPARK Matrix™: Low Code Application Development Platform, 2021
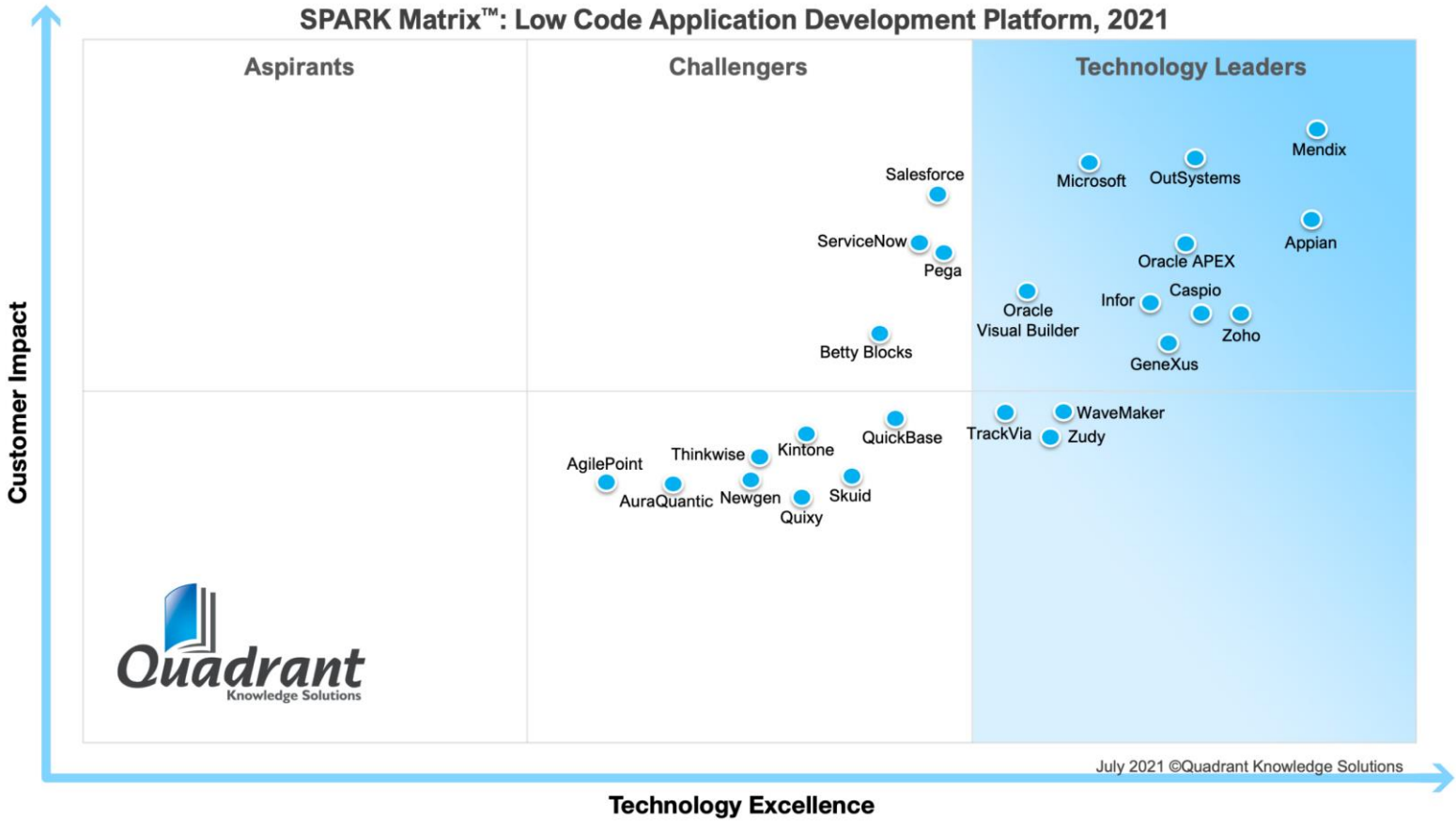
Vendors Profile

Following are the profiles of the leading Low Code Application Development platform vendors with a global impact. The following vendor profiles are written based on the information provided by the vendor's executives as part of the research process. Quadrant research team has also referred to the company's website, whitepapers, blogs, and other sources for writing the profile. A detailed vendor profile and analysis of all the vendors, along with various competitive scenarios, are available as a custom research deliverable to our clients. Users are advised to directly speak to respective vendors for a more comprehensive understanding of their technology capabilities. Users are advised to consult Quadrant Knowledge Solutions before making any purchase decisions, regarding LCAD platform solution and vendor selection based on research findings included in this research service.

Zoho

URL: https://www.zoho.com/creator/

Founded in 1996 and headquartered in Chennai, India, Zoho is a provider of business, collaboration, and productivity applications. The company offers a low-code platform named Zoho Creator. The platform offers end-to-end capabilities to build scalable and secure custom web and mobile apps, which can be extended and integrated with a host of third-party applications. It also ensures efficient productivity for all kinds of developers. On one end, this includes business users popularly called citizen developers with the minimal technical know-how on how to build an app but a good grasp of the business processes. On the other end are professional developers who are looking to do more with less. Zoho Creator offers comprehensive functionalities, including graphical and non-graphical builders, pre-integrated AI, ML, and analytical capabilities, API and integration services, governance and control, provision for deploying cloud functions & serverless capabilities, and hyper customization of the application user interface, amongst others.

Zoho Creator's intuitive graphical and non-graphical builders maximize the developer's productivity for both the business users and the IT developers' teams. The graphical drag and drop builder include various tools, such as form builder, report builder, flow (integration) builder, workflow builder, record layout designers, page builder, KPI builder, and schema builder, amongst others. Under non-graphical builders, Zoho Creator offers its own proprietary guided coding language called Deluge, and also supports other languages such as Java, and Node.js to write workflows and functions of applications. Additionally, the Deluge Server Page editor and ZML (Zoho Markup Language) Server Page editor can write dynamic HTML/CSS programs. The pre-integrated AI, ML, and analytical capabilities include AI services, AI predictions, AI forecasting, along with an AI assistant 'Ask Zia', which processes common questions and responds with visual results. It also provides NLP-based technology to cleanse various types of input data and integrate it with third-party cognitive and analytics services offerings, amongst various others.

Zoho provides API and Integration Services through Deluge to connect with third-party APIs using GET, POST, PUT, PATCH, and DELETE methods of HTTP. Creator also has RESTful APIs that can be used to interface with other Creator apps to fetch, add, update, and delete data for which authentication is enabled adhering to OAuth2.0. The Zoho Creator platform also comes with a number of governance controls including authorization based on organizational hierarchy and roles. In addition, it provides a multi-developer environment and programmatic access controls leveraging Deluge.

Zoho Creator also provides cloud functions opened with the backend business logic layer by extending programming capabilities in Java and Node.js. In addition, the serverless

capability comprises– microservices, Backend as a Service (BaaS) and Function as a Service (FaaS) to support the overall infrastructure. The hyper-customized user interface enhances the application development experience and can be applied across all devices with the same source code. Additionally, it enables the developers to turn the UI extension into a component that can be distributed to other users across the organization.

Analyst Perspective

Following is the analysis of Zoho Creator's capabilities in the Low Code Application Development platform market:

♦ Zoho offers an LCAD platform that enables designing a low-code application while ensuring security, scalability, and timely updates of the apps created by the developers. The company primarily provides a SaaS platform for its users globally, which runs on the same infrastructure as Zoho's services. Zoho infrastructure provides the software infrastructure needed for the app, like the OS layer in which the apps run, the server layer in which the OS runs, and the network layer that hosts all the servers. In order to have absolute control of data and data management, Zoho has 10 data centres across the globe. Also, faster disaster recovery reduces latency and improves the customer experience and performance of the application. In addition to the SaaS version, Zoho also offers an on-premises version of the platform.

♦ Some of the key differentiators for Zoho's LCAD platform offering include a unified data model to patch solutions together from disparate applications, systems, and technology stacks to make the system work seamlessly. Additionally, the Multi-Persona App Development platform offers the developers better user experience and scalability for a range of skill sets, from pro-code to low-code to no-code. Zoho's LCAD platform also appeals to the broadest user base of any LCAD platform in the market. The company also provides a Zoho ecosystem that enables application development across sales, marketing, enterprise operations, and finance amongst others to grow their existing product suite broader and deeper. The company has implemented a number of AI services such as prediction, keyword extraction, sentiment analysis, OCR, and object detection, amongst others, at the application level. Zoho Creator's AI capabilities can also be accessed through both the drag-and-drop builder and through programming custom Deluge tasks. Finally, full-spectrum development allows applications to be built for a number of different devices like web, native mobile for iOS and Android as well as a PWA with an option of device-specific customization, which again stands out as a differentiating feature for the company's LCAD offering.

♦ In terms of geographical presence, Zoho has a commanding presence in North America, especially the US, followed by European Union and the Asia Pacific region.

It has a significant presence in the Middle East & Africa, and Latin America. Zoho holds a strong customer base, including some of the leading brands across industry verticals such as professional services, banking & financial services, insurance, manufacturing, education, logistics, and healthcare, amongst others. Some of the top use cases for Zoho in the LCAD platform domain include quotation management, employee management, project trackers, sales management, content and review release, fleet hub, library and course management, business finance trackers, and support desks, amongst many others.

♦ The primary challenges of Zoho include its ability to differentiate its offering amongst a growing number of emerging LCAD platform vendors, as well as overcoming competitive scenarios emerging due to ongoing mergers, acquisitions, and collaborations of LCAD platform specialists. However, with an effective competitive and growth strategy and with a continued focus on its robust technology platform, ecosystem strategy, value-based pricing, and strong industry experience, Zoho is well-positioned to improve its market share in the global LCPD market.

♦ Moving forward, the company will continue to focus on major highlights of the product roadmap that includes the release of the next-generation Zoho Creator (C6) with the aim of democratizing application development across different developer personas. One aspect of the new version is to enhance the design experience with situation layout, process blueprints, intelligent assistant Zia, and systematic touchpoints. The second aspect of the roadmap would be to focus on improving the overall developer experience, which includes capabilities that will help IT stakeholders maintain the integrity of the application ecosystem while enabling democratization. Major highlights under the developer's experience include assisted development integrated to the Zia assistant, unified data service and automation, and staging and automated testing to control the changes that need to be deployed on production processes. In terms of solution analytics, the company would be facilitating customizable central dashboards for monitoring application usage and performance, catering to organizational administrators, application owners, and individual users.

Research Methodologies

Quadrant Knowledge Solutions uses a comprehensive approach to conduct global market outlook research for various technologies. Quadrant's research approach provides our analysts with the most effective framework to identify market and technology trends and helps in formulating meaningful growth strategies for our clients. All the sections of our research report are prepared with a considerable amount of time and thought process before moving on to the next step. Following is a brief description of the major sections of our research methodologies.
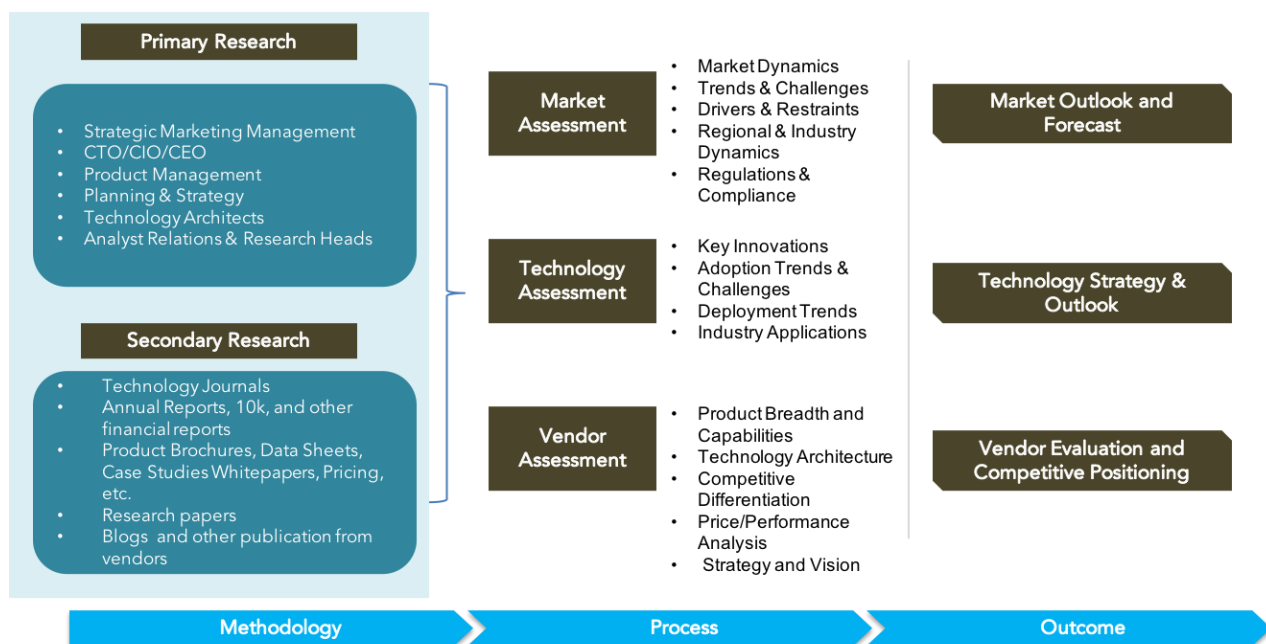
Secondary Research

Following are the major sources of information for conducting secondary research:

Quadrant's Internal Database

Quadrant Knowledge Solutions maintains a proprietary database in several technology marketplaces. This database provides our analyst with an adequate foundation to kick-start the research project. This database includes information from the following sources:

- Annual reports and other financial reports
- Industry participant lists
- Published secondary data on companies and their products
- Database of market sizes and forecast data for different market segments
- Major market and technology trends

Literature Research

Quadrant Knowledge Solutions leverages on several magazine subscriptions and other publications that cover a wide range of subjects related to technology research. We also use the extensive library of directories and Journals on various technology domains. Our analysts use blog posts, whitepapers, case studies, and other literature published by major technology vendors, online experts, and industry news publications.

Inputs from Industry Participants

Quadrant analysts collect relevant documents such as whitepaper, brochures, case studies, price lists, datasheet, and other reports from all major industry participants.

Primary Research

Quadrant analysts use a two-step process for conducting primary research that helps us in capturing meaningful and most accurate market information. Below is the two-step process of our primary research:

Market Estimation: Based on the top-down and bottom-up approach, our analyst analyses all industry participants to estimate their business in the technology market for various market segments. We also seek information and verification of client business performance as part of our primary research interviews or through a detailed market questionnaire. The Quadrant research team conducts a detailed analysis of the comments and inputs provided by the industry participants.

Client Interview: Quadrant analyst team conducts a detailed telephonic interview of all major industry participants to get their perspectives of the current and future market dynamics. Our analyst also gets their first-hand experience with the vendor's product demo to understand their technology capabilities, user experience, product features, and other aspects. Based on the requirements, Quadrant analysts interview with more than one person from each of the market participants to verify the accuracy of the information provided. We typically engage with client personnel in one of the following functions:

- Strategic Marketing Management
- Product Management
- Product Planning
- Planning & Strategy

Feedback from Channel Partners and End Users

Quadrant research team research with various sales channel partners, including distributors, system integrators, and consultants to understand the detailed perspective of the market. Our analysts also get feedback from end-users from multiple industries and geographical regions to understand key issues, technology trends, and supplier capabilities in the technology market.

Data Analysis: Market Forecast & Competition Analysis

Quadrant's analysts' team gathers all the necessary information from secondary research and primary research to a computer database. These databases are then analyzed, verified, and cross-tabulated in numerous ways to get the right picture of the overall market and its segments. After analyzing all the market data, industry trends, market trends, technology trends, and key issues, we prepare preliminary market forecasts. This preliminary market forecast is tested against several market scenarios, economic scenario, industry trends, and economic dynamics. Finally, the analyst team arrives at the most accurate forecast scenario for the overall market and its segments.

In addition to market forecasts, our team conducts a detailed review of industry participants to prepare competitive landscape and market positioning analysis for the overall market as well as for various market segments.

SPARK Matrix: Strategic Performance Assessment and Ranking

Quadrant Knowledge Solutions' SPARK Matrix provides a snapshot of the market positioning of the key market participants. SPARK Matrix representation provides a visual representation of market participants and provides strategic insights on how each supplier ranks in comparison to their competitors, concerning various performance parameters based on the category of technology excellence and customer impact.

Final Report Preparation

After finalization of market analysis and forecasts, our analyst prepares necessary graphs, charts, and table to get further insights and preparation of the final research report. Our final research report includes information including market forecast; competitive analysis; major market & technology trends; market drivers; vendor profiles, and such others.