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Digitalizing Project Execution for Optimized Completion Schedule

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Abstract: **Digital technologies have transformed project execution by providing powerful tools for optimizing project completion schedules and reducing the risk of delays. In this paper, we explore the use of digital technologies for optimized project execution. We begin with an introduction to the potential benefits of digital technologies for project execution. We then discuss specific digital technologies that can be used to optimize completion schedules. We present a case study that demonstrates how the digital technologies were used to optimize the completion schedule of a construction project. The case study highlights the benefits of using digital technologies for project execution, including improved collaboration, real-time insights into project performance, and reduced risk of delays. Finally, we conclude with a summary of our findings and recommendations for practitioners and policymakers on how to leverage digital technologies for optimized project execution. Our results show that digital technologies can significantly improve project efficiency and effectiveness, leading to timely project completion and reduced costs.**

Keywords: **Digitalizing Project Execution, optimizing project, digital technologies, construction project.**

1. INTRODUCTION

The schedule in project management contains a list of milestones, activities and deliverables distributed in a certain sequence with planned start and end dates for each activity, where the overall planned start and end date determines the project execution timeframe. As it is important in project management to have an efficient and optimized project execution, this paper will provide an overview on the importance of digital technologies and its impact on optimizing the project execution schedule.

The project schedules can be optimized by several techniques, such as; Reassignment of resources from activities that are not on the project critical path and have a free float to activities falls on the critical path, increase of project resources, tools and equipment to allow for multiple and in parallel execution of project activities, reevaluating the specification of project used material and consider an acceptable replacement with alternatives that have less delivery schedule, consider payment of expediting fees and premiums to the execution contractors and equipment vendors to expedite execution schedules, and utilize digital tools, technologies and equipment to optimize the completion schedules for the project activities.

The project schedule can be optimized through capitalizing on the evolved digital technologies tools and multiple enablers and taking the advantage of its important role in improving the projects execution. This as well supports Saudi Aramco vision to become “the world's leading digitalized energy corporation, maximizing shareholder value and spearheading digital innovation in energy globally” [1]. The digital technologies can be used in several phases throughout the project lifecycle, such as; planning, execution, monitoring and controlling and project’s closure.

In general, the use of digital technologies can significantly improve project execution by providing project management team with better visibility, insights, and tools to have efficient and optimized execution schedule.

2. DIGITAL TECHNOLOGIES FOR PROJECT EXECUTION

There are various digital technologies that can be used to optimize project execution during different project execution phases. Below section includes some of the commonly used digital technologies with descripting its influence on the project schedule optimization.

1. A digital twin is a virtual model of a physical asset, process, or system that can be utilized for simulation, analysis, and optimization. In the realm of project construction, digital twin technology can be employed to create a virtual representation of a building, infrastructure, or facility, and simulate its construction process. The implementation of digital twin technology in project construction can improve the schedule by enhancing planning and scheduling, reducing the risk of delays and cost overruns, optimizing construction sequencing, testing different scenarios, and facilitating communication and collaboration among project team members. By utilizing virtual simulation and analysis, project managers can make more informed decisions and adjust the schedule as required, resulting in a more efficient and successful construction project. Digital twin technology provides a virtual representation of the physical asset, process, or system.

Digital twin technology also enhances communication and collaboration among project team members. The virtual representation of the construction project can be shared with all stakeholders, allowing for more effective communication and collaboration. This can help to improve decision-making, reduce misunderstandings, and enhance overall project outcomes. Furthermore, digital twin technology can be used to optimize the scheduling of construction activities. This can help project managers to better allocate resources and optimize the use of labor, equipment, and materials. Digital twin technology can also be used to enhance the quality and safety of the construction process. By simulating the construction process, project managers can identify potential safety hazards and quality issues before construction begins, allowing for proactive risk mitigation and quality control.

Overall, the use of digital twin technology in project construction can significantly enhance the schedule by improving planning and scheduling, reducing the risk of delays and cost overruns, optimizing construction sequencing, testing different scenarios, and enhancing communication and collaboration among project team members. Through virtual simulation and analysis, project managers can make more informed decisions and adjust the schedule as required, resulting in a more efficient and successful construction project. **[2]**

2. Enterprise project management (EPM) refers to a collection of tools and processes that aid organizations in managing multiple projects and programs at the enterprise level. In the realm of project construction, EPM can significantly improve the schedule by enhancing resource management, portfolio management, risk management, reporting and analytics, as well as collaboration and communication. By utilizing EPM tools and processes, project managers can make more informed decisions and adjust the schedule as required, resulting in a more efficient and successful construction project. Effective resource management is a critical component of successful project construction. EPM tools and processes can assist project managers in allocating resources optimally, ensuring that labor, equipment, and materials are used efficiently. This can help to minimize waste, reduce the risk of delays, and keep the project on schedule and within budget. Furthermore, portfolio management is another area where EPM can enhance the construction project's schedule. EPM tools and processes can be used to manage the entire portfolio of construction projects, providing project managers with a comprehensive view of all projects within the organization. This can help project managers to prioritize projects, allocate resources, and optimize project sequencing to ensure that the entire portfolio is delivered on time and within budget. Risk management is another crucial aspect of project construction that can benefit from EPM tools and processes. By identifying potential risks and developing strategies to mitigate them, project managers can reduce the risk of delays and cost overruns. EPM tools and processes can provide project managers with real-time data and analysis, enabling them to monitor and manage risks effectively throughout the project's lifecycle. EPM tools and processes can also improve reporting and analytics, allowing project managers to monitor project progress and performance more effectively. By providing real-time data on project metrics, such as budget, schedule, and quality, project managers can identify potential issues and take corrective action before they become significant problems. Lastly, EPM tools and processes facilitate collaboration and communication

among project team members. By providing a centralized platform for all stakeholders to access and share project information, EPM tools and processes can reduce misunderstandings and improve coordination, leading to a smoother and more efficient construction process.

In summary, EPM is a collection of tools and processes that can improve the schedule of project construction by enhancing resource management, portfolio management, risk management, reporting and analytics, as well as collaboration and communication. By utilizing EPM tools and processes, project managers can make more informed decisions and adjust the schedule as required, resulting in a more efficient and successful construction project. **[3]**

3. 3D modeling refers to the creation of a digital, three-dimensional representation of a physical object or structure. In the context of project construction, 3D modeling can significantly enhance the schedule by improving visualization, communication, simulation, optimization, and reducing rework. By utilizing virtual 3D modeling tools, project managers can make informed decisions and adjust the schedule as required, resulting in a more efficient and successful construction project. One of the primary benefits of 3D modeling is enhanced visualization. With 3D modeling, project managers can create a realistic digital representation of the project, enabling stakeholders to visualize the end result and understand how the project will look and function. This can help to ensure that all parties are on the same page, reducing misunderstandings, and improving collaboration. Communication is another area where 3D modeling can enhance the construction project's schedule. With a 3D model, project managers can communicate project details more effectively, providing stakeholders with a clear understanding of the project's scope, timeline, and budget. This can help to reduce the risk of delays and cost overruns, as all parties are aware of the project's requirements and constraints. Simulation and optimization are other areas where 3D modeling can improve the schedule of project construction. By simulating the construction process using a 3D model, project managers can identify potential issues and optimize the construction process to reduce the risk of delays and cost overruns. This can help to ensure that the project is completed on time and within budget, while also improving the quality of the final product.

3D modeling can reduce rework by identifying potential issues before construction begins. With a 3D model, project managers can identify potential clashes between different building systems, such as mechanical, electrical, and plumbing, before construction begins. This can help to reduce the need for rework and ensure that the project is completed on time and within budget.

In conclusion, 3D modeling can significantly enhance the schedule of project construction by improving visualization, communication, simulation, optimization, and reducing rework. By leveraging virtual 3D modeling tools, project managers can make informed decisions and adjust the schedule as required, resulting in a more efficient and successful construction project.

4. Augmented reality (AR) technology offers numerous benefits for project construction, enhancing the schedule in various ways. Firstly, AR provides a realistic and detailed visualization of the project in the real world, helping to identify potential conflicts and issues early in the process. This can help project managers to make informed decisions and adjust the schedule accordingly, reducing the risk of delays and cost overruns. Secondly, AR improves communication and collaboration among project team members, contractors, and stakeholders by providing a common platform to access and visualize the project. This leads to better coordination and a smoother construction process, reducing the risk of misunderstandings and improving overall project outcomes. Thirdly, AR can simulate different scenarios and what-if analyses, allowing project managers to make informed decisions and adjust the schedule accordingly. By simulating the construction process, project managers can optimize construction sequencing and scheduling, reducing the time and risk of delays. Fourthly, AR can be used to provide on-the-job training to workers, reducing the time and cost associated with traditional training methods. This can

help to improve worker productivity and reduce the risk of errors and accidents, leading to a more efficient and successful construction project. Finally, AR can reduce rework and change orders by identifying potential clashes and interferences before construction begins. **[4]**

By identifying and resolving potential issues early in the process, project managers can reduce the need for expensive rework and change orders, further improving the project's schedule and budget.

In summary, AR technology offers numerous benefits for project construction, enhancing the schedule by providing realistic and detailed visualizations of the project, improving communication and collaboration among stakeholders, simulating different scenarios and what-if analyses, optimizing construction sequencing and scheduling, providing on-the-job training to workers, and reducing rework and change orders. By leveraging AR technology, project managers can make informed decisions, improve efficiency, and reduce the risk of delays or cost overruns, resulting in a more efficient and successful construction project.

5. Drones are unmanned aerial vehicles that can be used in project construction to improve the schedule in various ways. Firstly, they can conduct site surveys and generate high-resolution maps and 3D models of the construction site, helping project managers to better understand site conditions and plan activities more effectively. Secondly, drones can monitor and inspect construction progress and identify potential issues and conflicts early in the process, ensuring compliance with design specifications and safety regulations. Thirdly, they can perform quality control inspections on construction materials and structures, identifying defects and reducing the risk of rework and delays. Fourthly, drones can enhance safety on construction sites by providing real-time monitoring of workers and equipment, detecting potential hazards and enabling preventive measures.

Drones can transport materials and equipment to hard-to-reach areas on construction sites, reducing the time and cost of traditional transportation methods.

By leveraging drones, project managers can make informed decisions and adjust the schedule accordingly, resulting in a more efficient and successful construction project.

6. Chatbots are computer programs that simulate conversation with human users, and they can be used in project construction to improve the schedule in various ways. Firstly, chatbots can manage project information and resources, providing real-time access to schedules, budgets, and materials, enabling project managers to make informed decisions and adjust the schedule accordingly. Secondly, chatbots can improve communication and collaboration among project team members, contractors, and stakeholders, providing a common platform to access and share project information, reducing misunderstandings and improving coordination. Thirdly, chatbots can automate routine tasks such as scheduling meetings and updating project information, freeing up project managers' time to focus on more strategic tasks. Fourthly, chatbots can provide on-demand training and support to workers and contractors, answering questions and providing guidance in real-time, leading to improved efficiency and productivity. **[5]**

Chatbots can collect feedback and analyze data on project performance, helping project managers to identify potential issues and opportunities for improvement, allowing them to adjust the schedule accordingly and optimize project performance.

By leveraging artificial intelligence and automation, project managers can streamline routine tasks, optimize project performance, and reduce the time and cost associated with traditional project management methods. Chatbots can improve communication and collaboration, provide real-time feedback and analysis, and ultimately lead to a more efficient and successful construction project.

7. Satellites can capture high-resolution images of a construction site, providing a detailed view of the terrain, topography, and infrastructure, which can be used to create accurate and detailed maps of the site, helping project managers to plan construction activities more effectively. Satellites can also monitor and inspect construction progress, ensuring compliance with design specifications and safety regulations, and identifying potential delays. Satellites can perform quality control inspections, identifying defects, anomalies, and inconsistencies, reducing the risk of rework and delays. Satellites can monitor environmental factors that could impact construction activities, such as weather patterns, natural disasters, and changes in land use, providing real-time data and alerts to help project managers adjust the schedule and take preventive measures to minimize the impact of these factors.

Satellites can enhance communication and collaboration among project teams, contractors, and stakeholders, reducing misunderstandings and improving coordination, leading to a smoother and more efficient construction process. Satellites

can also identify and manage project risks more effectively, providing real-time data on potential hazards and risks, helping project managers to take preventive measures and adjust the schedule accordingly, reducing the likelihood and impact of delays and cost overruns.

In summary, the use of satellites in project construction can enhance the schedule by improving site surveying, monitoring and inspection, quality control, environmental monitoring, communication and collaboration, and risk management. By leveraging the power of satellite technology, project managers can make more informed decisions and adjust the schedule accordingly, resulting in a more efficient and successful construction project, while reducing the time and cost associated with traditional construction methods.

8. Cloud-based platforms that use 360-degree camera technology can be used to create virtual walkthroughs of construction sites, which can enhance the construction project schedule in multiple ways. Firstly, this can provide visualization of the project, enabling project managers and stakeholders to identify potential issues and conflicts early on, allowing for better planning and scheduling. Secondly, it can improve communication and collaboration among project team members, contractors, and stakeholders. Thirdly, it can simulate different scenarios and what-if analyses, enabling project managers to make informed decisions and adjust the schedule accordingly. Fourthly, it can optimize construction sequencing and improve scheduling, reducing the time it takes to complete the project and the risk of delays. Fifthly, it can reduce rework and change orders by identifying potential issues and conflicts before construction begins. Sixthly, it can track construction progress in real-time, enabling project managers to monitor progress, identify bottlenecks and potential delays, and adjust the schedule accordingly. **[6]**

This technology can be used to document the construction process, generating reports for stakeholders and regulatory bodies, ensuring compliance with regulations and reducing the risk of disputes and litigation.

The use of cloud-based virtualization of work sites in project construction can enhance the schedule by improving visualization, communication, simulation, optimization, progress tracking, and documentation. By leveraging the power of virtual walkthroughs and real-time data, project managers can make more informed decisions and adjust the schedule accordingly, resulting in a more efficient and successful construction project. This technology can help to reduce the time and cost associated with traditional construction methods, improve safety and quality control, and provide real-time monitoring and data analysis, leading to a more streamlined construction process.

9. Smart helmets are wearable devices that use sensors, cameras, and other technologies to provide real-time data and analysis on construction activities and worker safety. In the context of project construction, smart helmets can be used to enhance the schedule in several ways. Firstly, they can monitor worker safety and detect potential hazards and risks on construction sites. Secondly, they can improve communication and collaboration among project team members, contractors, and stakeholders. Thirdly, they can perform quality control inspections on construction materials and structures. Fourthly, they can track worker productivity and resource utilization in real-time. Fifthly, they can provide on-demand training and support to workers and contractors. Sixthly, they can monitor environmental factors that could impact construction activities.

The use of smart helmets in project construction can enhance the schedule by improving safety management, communication, quality control, productivity tracking, training and support, environmental monitoring, and documentation.

By leveraging the power of wearable technology and real-time data, project managers can make more informed decisions, streamline routine tasks, and optimize project performance, resulting in a more efficient and successful construction project.

10. Robotics can be utilized in project construction to enhance the schedule in various ways. Firstly, robotics can automate routine and repetitive tasks, reducing the time and cost associated with these tasks, and help to speed up the construction process. Secondly, robotics can perform construction tasks with greater precision and accuracy than human workers, reducing the risk of errors and rework, and improving quality control. Thirdly, robotics can be used to perform hazardous and dangerous tasks, reducing the risk of accidents and injuries, and improving worker safety. Fourthly, robotics can help in managing project resources by providing real-time visibility into resource availability and utilization, optimizing resource allocation, and reducing conflicts and delays. Fifthly, robotics can collect and analyze data on project performance, identifying potential issues and opportunities for improvement, and optimizing project performance. Sixthly, robotics can be used for site surveying and inspection, providing high-resolution images and data on the construction site, enabling project managers to identify potential issues and conflicts early in the process. **[7]**

Robotics can be programmed to perform a wide range of construction tasks, allowing project managers to adjust to changes in project scope or design, improving flexibility and optimizing scheduling.

The use of robotics in project construction can enhance the schedule by improving automation, precision and accuracy, safety, resource management, data collection and analysis, site surveying and inspection, and flexibility.

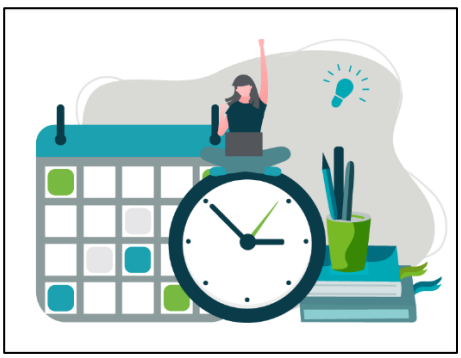
11. Laser scanning technology can be utilized in project construction to enhance the schedule in several ways. Firstly, laser scanning can be used to create 3D models of the construction site, providing a detailed and accurate view of the terrain, topography, and infrastructure. This information can be used to create accurate and detailed maps of the site, helping project managers to plan construction activities more effectively. Secondly, laser scanning can be used to create accurate 3D models of existing structures, allowing project managers to design and plan construction activities more effectively. Thirdly, laser scanning can be used to perform quality control inspections on construction materials and structures, reducing the risk of rework and delays. Fourthly, laser scanning can track construction progress in real-time by capturing images and data from the site, helping project managers to monitor progress and adjust the schedule accordingly. Fifthly, laser scanning can be used to detect conflicts and interferences between construction elements, allowing for better planning and scheduling. **[8]**

The use of laser scanning technology in project construction can enhance the schedule by improving site surveying, design and planning, quality control, progress tracking, communication and collaboration, conflict detection, and environmental monitoring. By leveraging the power of laser scanning technology and real-time data, project managers can make more informed decisions, resulting in a more efficient and successful construction project.

12. Inventory management technologies, such as RFID and barcode scanning, can be used in project construction to improve scheduling and resource allocation, reduce the risk of delays, and enhance the overall construction process. Real-time visibility provided by inventory management technologies allows project managers to optimize scheduling and resource allocation, reducing the risk of delays and cost overruns. Improved efficiency through automation of inventory tracking and management also helps to improve efficiency and reduce the risk of errors and delays. Inventory management technologies can help prevent stockouts and delays by providing real-time data on inventory levels and usage, allowing project managers to proactively manage inventory levels and prevent shortages. Additionally, inventory management technologies can be used to perform quality control inspections on construction materials and equipment, identifying defects, anomalies, and inconsistencies and reducing the risk of rework and delays. Managing project resources, such as labor, equipment, and materials, can also benefit from inventory management technologies through real-time visibility into resource availability and utilization, helping project managers to allocate resources more effectively and minimize conflicts and delays. Inventory management technologies can also be used to document the construction process and generate reports for stakeholders and regulatory bodies, providing a detailed and accurate record of inventory levels, usage, and quality control inspections. This helps to ensure compliance with regulations and reduce the risk of disputes and litigation. **[9]**

Inventory management technologies can help to reduce the time and cost associated with traditional methods, improve safety and quality control, and provide real-time monitoring and data analysis, leading to a more streamlined process and a more successful project outcome.

3. OPTIMIZING COMPLETION SCHEDULES



Digital technologies have transformed project management by providing powerful tools for optimizing project completion schedules. Here are some key strategies for using these technologies to ensure timely project delivery:

Predictive Analytics: Predictive analytics involves using historical data and statistical algorithms to identify patterns and predict future outcomes. In project management, predictive analytics can help you forecast project completion dates by analyzing past project performance, current project status, and other relevant data. By using predictive analytics, you can identify potential delays or issues that may impact project completion and take corrective action before they become major problems.

Real-time Monitoring: Real-time monitoring involves using digital tools to track project progress in real-time. This can include monitoring the status of individual tasks, tracking resource utilization, and identifying potential bottlenecks or delays. Real-time monitoring can help you identify issues as they arise, allowing you to take corrective action quickly and keep your project on track.

Automated Task Scheduling: Automated task scheduling involves using digital tools to automatically schedule tasks based on project timelines, resource availability, and other relevant data. This can help you optimize resource utilization and ensure that tasks are completed in the most efficient manner possible. By automating task scheduling, you can reduce the risk of delays and ensure that your project stays on schedule.

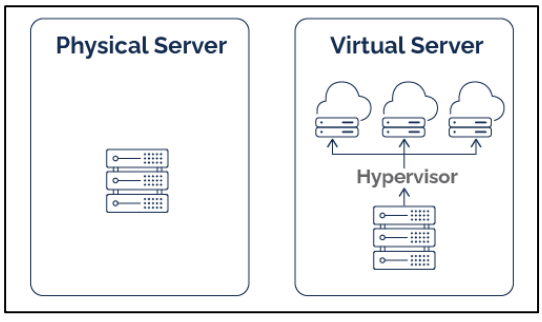
Agile Project Management: Agile project management is an iterative approach to project management that emphasizes collaboration, flexibility, and continuous improvement. With agile project management, you can use digital tools to facilitate communication and collaboration among team members, allowing you to quickly adapt to changing project requirements and address issues as they arise.

Cloud Computing: Cloud computing involves using remote servers to store, manage, and process data. By using cloud computing, you can access project data from anywhere, collaborate with team members in real-time, and take advantage of powerful computing resources without the need for expensive hardware or software.

By leveraging these digital technologies, you can optimize your project completion schedules, reduce the risk of delays, and ensure timely project delivery. **[10]**

4. CASE STUDY

In modern industrial facilities, automation and control systems are critical to ensuring safe and efficient operation. As these systems age, however, they can become obsolete and require costly upgrades to maintain functionality. To overcome these challenges, virtualization technology can be used to run multiple operating systems and software applications on a single physical server, thereby reducing the dependency of the OS and Vendor Application software on physical hardware. This technology offers numerous advantages over traditional PC-based workstations and servers, including longer lifespans for Process Automation application software and reduced costs and complexity for upgrading automation application software.



A notable example of the application of virtualization technology in industrial automation is the Yanbu bulk plant, where virtual servers were utilized as part of the BI-10-00610 project to integrate Terminal Management System (TMS) signals with the existing PLC system. This allowed for the overcoming of system obsoleteness issues and limitations, resulting in a 7-month schedule reward and cost savings. The benefits were reviewed and validated, and recorded in a Project Management DT value realization report in Q1 2021.

One of the primary advantages of virtualization technology is its ability to minimize the dependency of the OS and Vendor Application software on physical hardware. In traditional PC-based workstations and servers, upgrading from an old model to a newer model typically requires upgrading the automation application software, which can be a costly and complex process that involves the conversion of process graphics and control databases. In contrast, virtual servers enable the replacement of failed servers with newer model servers without impacting the operating systems and application software

running on the server. This reduces the cost and complexity of upgrading automation application software and results in a longer lifespan for Process Automation application software.

Another advantage of virtualization technology is its ability to improve system reliability and availability. By running multiple operating systems and software applications on a single physical server, virtualization technology can provide greater redundancy and fault tolerance, reducing the risk of system downtime and data loss. Virtualization also makes it easier to perform backups and disaster recovery, allowing for faster system restoration in the event of a failure.

In addition to the benefits mentioned above, virtualization technology can also offer advantages in terms of energy efficiency and space utilization. By consolidating multiple servers onto a single physical server, virtualization can reduce power consumption, cooling requirements, and physical space requirements, resulting in lower operating costs and a smaller environmental footprint.

As industrial facilities continue to rely on automation and control systems to ensure safe and efficient operation, virtualization technology is becoming an increasingly important tool for optimizing system performance and reducing costs. However, it is important to note that virtualization technology also introduces new security risks, such as the potential for unauthorized access to virtual machines and the possibility of malware spreading between virtual machines. To mitigate these risks, it is important to implement appropriate security measures, such as network segmentation, access controls, and regular software updates.

In conclusion, virtualization technology offers numerous advantages for industrial automation, including longer lifespans for Process Automation application software, reduced costs and complexity for upgrading automation application software, improved system reliability and availability, and energy efficiency and space utilization benefits. By implementing virtualization technology, industrial facilities can optimize system performance and reduce costs, while also mitigating potential security risks through appropriate security measures.

5. CONCLUSION

Digital technologies have transformed project management by providing powerful tools for optimizing project completion schedules and reducing the risk of delays. These technologies offer real-time insights into project performance, allowing project managers to identify potential issues and take corrective action quickly. Here are some recommendations for practitioners and policymakers on how to leverage digital technologies for optimized project execution and completion:

1. Invest in digital project management tools: Organizations should invest in digital project management tools that can help optimize project completion schedules, improve collaboration among team members, and provide real-time insights into project performance. Project management software can streamline project workflows, automate repetitive tasks, and facilitate communication and collaboration among team members.

2. Train project managers and team members: It is important to train project managers and team members on how to use digital technologies effectively. This includes providing training on project management software, data analytics tools, and other digital technologies that can help improve project efficiency and effectiveness. Ongoing learning and development in this area should also be encouraged.

3. Foster a culture of innovation and experimentation: Organizations should encourage team members to explore new digital tools and techniques that can help improve project efficiency and effectiveness. This can include experimenting with data analytics tools, exploring new collaboration platforms, or testing new project management methodologies.

4. Develop policies and guidelines for the use of digital technologies: Policies and guidelines should be developed for the use of digital technologies in project management, considering issues such as data security, privacy, and ethics. Organizations should establish clear guidelines for the use of project management software, data analytics tools, and collaboration platforms, and ensure that team members are trained on these guidelines.

5. Collaborate with other organizations and stakeholders: Organizations should collaborate with other organizations and stakeholders to share best practices and lessons learned in the use of digital technologies for project management. This can help organizations stay up-to-date with the latest trends and technologies in project management, and identify new opportunities for improving project efficiency and effectiveness.

In conclusion, digital technologies offer many benefits for project management, including optimized project completion schedules, reduced risk of delays, and real-time insights into project performance. By investing in digital project

management tools, training team members on the effective use of these tools, fostering a culture of innovation and experimentation, developing policies and guidelines, and collaborating with other organizations and stakeholders, organizations can leverage digital technologies to improve project efficiency and effectiveness. **[11]**

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