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The Mindful IT Company
Born Digital . Born Agile

BUILDING A BUSINESS-FOCUSED

DIGITAL FACTORY

Scaling Business through Digital Capital

Content

Introduction

The race to innovate has led to an abundance of solutions that are expensive, but often redundant, and overriding benefits. Every enterprise needs to reimagine how the ideation, execution, and implementation of digital solutions can be cost-effective, scalable, and reusable, maximizing returns on investment. Will the "Digital Factory" provide an answer? Let's find out!

Digital factories are those that operate like industrial factories with comparable assembly lines but in a software product development context. The concept promotes the development of easy-to-follow processes to build software products as components that can also be reused for future software product development. Once the process, skill and technology are established, fully functional project and product teams collaborate to deliver with quality and agility, enabling organizations to achieve their strategic and business goals with lesser time to value.

Key highlights of a digital factory:

- Digital business delivery
- Enhanced collaboration, co-creation, and reuse
- Streamlined, secure software product development lifecycle
- Constant improvement in software product delivery, quality, and speed
- Improved time to value.

The Transition toward Digital Factory

Similar to object-oriented progrmming (OOP) that is known for low coupling and high cohesion, in a digital factory, modules with their functionalities operate like independent, self-contained components with a well-defined purpose at the level of application, application programming interface (API), products, and services of a business unit.

A digital factory addresses challenges such as:

- Longer development and testing cycles
- Outdated delivery models
- Limited no-code and reusable modules
- Less or no interoperability in legacy systems
- A suffering business value chain

It offers a host of benefits, including:

- Better visibility and consistency in delivery with streamlined processes and collaboration
- Development of reusable modules enabling digital capital generation, avoiding redundancy
- Informed decision-making powered by analytics driving predictability
- Agility through automation
- Continuous improvement ensuring quality.

Why **DIGITAL FACTORY?**

How does **DIGITAL FACTORY** function?

The digital factory advocates to leverage best practices and patterns from existing software projects, products, platforms, and programs, and develop reusable assets in the form of templates, libraries, reference implementations, artifacts, APIs, design/-functional components, etc. It helps deliver domain- and business-specific software products with shared or common features, maximizing reuse of software components and processes. These reusable artifacts form the factory's digital capital.

From there, as new software products are developed, digital capital will continue to evolve and expand. Systematic reuse of digital capital that is already tested and proven ensures greater agility and quality and forms the core of the digital factory paradigm.

People, process and technology, the key drivers of product and project development, help achieve agility, quality, and constant improvement through continuous feedback generation. They form the key for any digital factory rollout.

People

are at the center of the digital factory. They are as instrumental as process improvement strategies and business process re-engineering to the success of the digital factory. A lack of focus on the organization's culture can lead to a failure of business re-engineering efforts and sustenance in the long run. People need to be engaged, empowered, and enabled with clear role definitions to be able to make the right decisions with respect to technology selection, process deployment, and personnel hiring.

The digital factory focuses on continuous learning, people empowerment through training, and effective inter- and intra-team collaboration to drive continuous improvement and reuse. People are required to be mindful to practice defined processes and employ appropriate technologies to deliver output with agility.

Processes

form the skeleton of the digital factory. They give software product development a well-defined structure that all teams abide by. Teams follow defined processes and established estimation techniques, gather feedback and act on it, adhere to process compliances, and participate in regular reviews enriched by meaningful metrics and key performance indicators (KPIs). They understand and maintain service level agreements, objectives, and indicators (SLAs, SLOs, and SLIs) to ensure uniformity that helps in creating digital capital.

In any software product delivery process, there is a continuous cycle of planning, development, integration, deployment, testing, delivery, monitoring, and feedback. When all process users and stakeholders have end-to-end visibility into the process cycle, it is possible to achieve better traceability and integration. This also results in self-sufficient teams collaborating at the technological and intellectual levels to deliver quality software products faster.

Technology

works like machinery in a manufacturing factory. In a digital factory, investments in tools and technology are well-planned so that they are scalable, flexible, and able to stand the test of time. Teams follow standard practices for digital capital contribution, consumption, maintenance, and approval, and assets are always up to date.

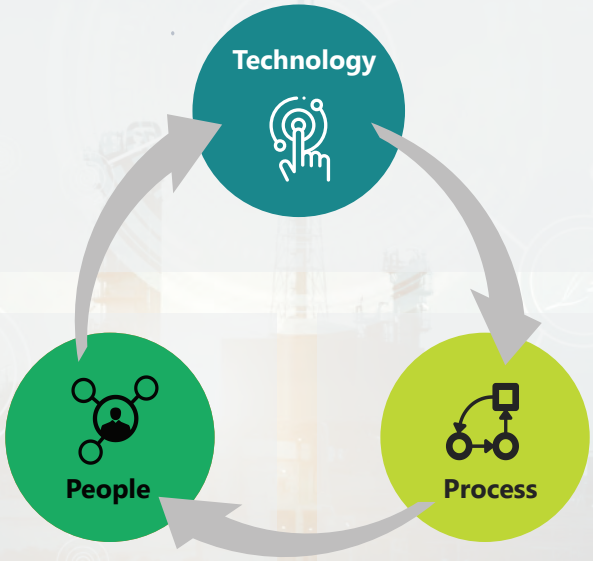
While taking advantage of the agility and responsiveness of a DevOps approach, IT security should also be well-integrated into the digital factory software product delivery, ensuring a focus on security from the early stages of software product development.

Digital factories follow proven approaches such as model-driven architecture, domain-driven architecture, domain-driven design, and test-driven development. This, along with an "everything as code" motto, enables business-domain-specific software code reuse to a great extent, cutting down time and effort spent on mundane activities.

A carefully designed digital factory can transform concepts into high-quality software products at the speed of relevance while reducing costs.

Consistency & Reuse

- Centralized Technology & Tools Stack Powered by Standards, Best Practices & Guidelines
- Focus on Security
- Automation First Approach
- Smart DevSecOps
- Digital Capital Centered Delivery



Culture, Capability & Productivity

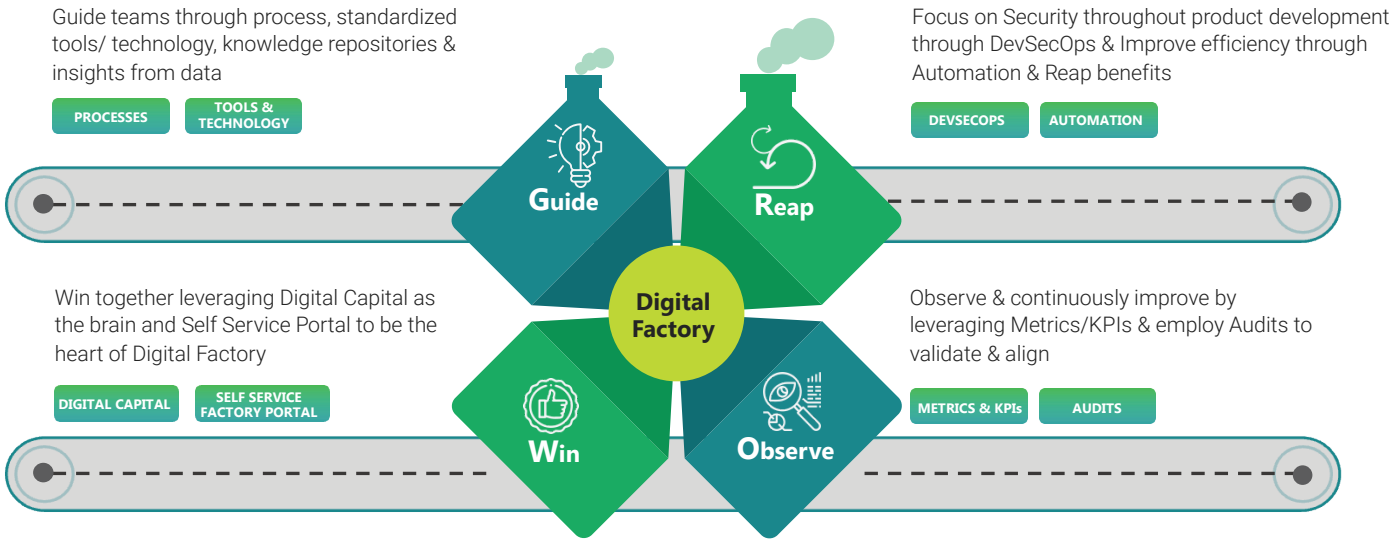
- Collaboration & Teamwork
- Transparency
- Continuous Innovation
- Decentralized Decision Making
- Fail Fast & Agile Culture
- Focused Trainings
- Digital Capital as DNA

Quality & Governance

- Established Processes & Methodologies
- Consistency of Practices
- Well defined Checklists/ Standards/ Best Practices
- Continuous Review, Feedback & Improvement
- Data Driven Insights

Framework
Digital Factory

The digital factory emphasizes the delivery of predictable, consistent outcomes seamlessly and with agility across the enterprise. The digital factory framework focuses on self-improving software development.



Happiest Minds' GROW framework employs the following approach for factory rollouts:

1. Adopt and adhere to agile practices to consistently roll out value-added software products.

2. Implement uniform standards and policies consistently across the organization.

3. Enhance team productivity through automation and infuse security at every step.

4. Leverage metrics- and KPI-driven insights to monitor success and improve.

5. Harvest, contribute, distribute & leverage digital capital in software product development to avoid redundancy and reduce time to market.

Guide | Processes – The Map

Clear and comprehensive documentation on roles, responsibilities, and actions that need to be taken under varied circumstances makes processes in a digital factory more predictable with a single source of truth. It helps in achieving better management control. The team is more productive and efficient. Feedback from all stakeholders helps define actionable goals and greater success.

Sticking to a well-defined process allows teams to: produce stable systems, ensure all stakeholders are appraised and have a clear understanding of the task at hand, come up with close estimates, and identify potential pitfalls early in the project. Over time, such teams will become more effective at determining issues before they even occur, helping them address or eliminate such problems efficiently. Identifying the right systems, embedding higher levels of automation, and generating meaningful insights to manage and optimize the lifecycle can help with backlog prioritization, prediction of affected test cases, identifying risks and challenges early in the cycle, etc. Software product and project lifecycle management—key to the success of a digital factory—needs focus right from the beginning. It facilitates traceability across lifecycle artifacts such as backlog items to requirements, tests, defects, code commits, and builds.

The Quality function with a digital factory focuses on definition, deployment, improvement (based on feedback), and enforcement of processes within the enterprise to drive the process, engineering, and business excellence. It also facilitates effective process communication and collaboration between business operations across the organization to produce results with high levels of stakeholder perceived value.

Product Development Methodology

Guide | Tools & Technology – The Transport

As a starting point, identifying, finalizing, and publishing appropriate tools and technologies—physical hardware or software—based on defined best practices, standards, and guidelines avoids tool redundancy. At the same time, there should be established governance to review, add, modify, and remove tools and technologies based on the perceived value of change driven by market trends and business requirements.

Teams across the enterprise should be able to leverage reusable components that are part of elaborate and centralized digital capital. Considering the variety of disparate technologies and supporting tools needed in an enterprise, it is important to make wise investments bearing in mind integration capabilities and their potential to support digital factory operations seamlessly.

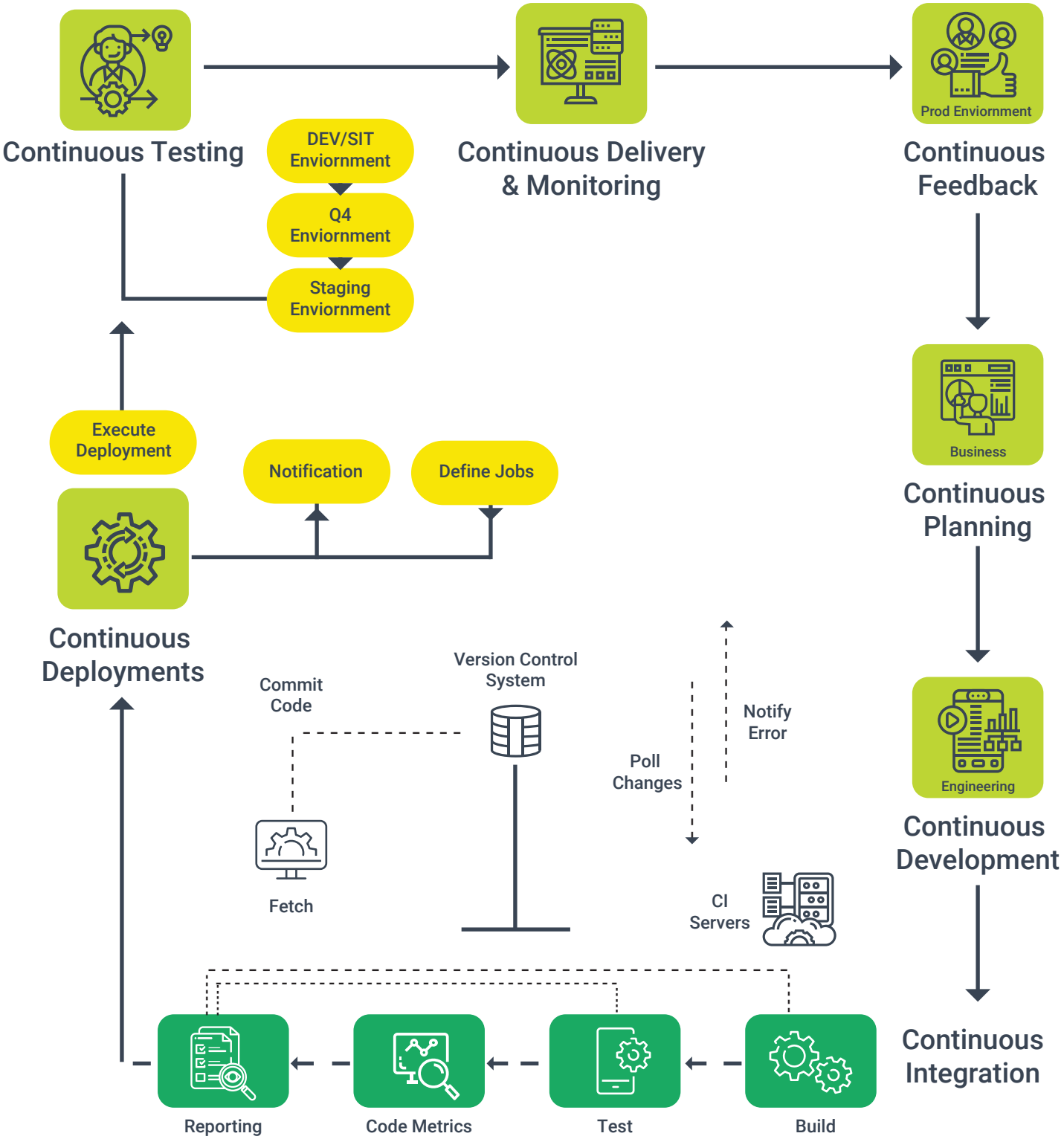
Tools and technologies and their adoption within the enterprise need to be centrally managed. Any tool or technology getting newly introduced, outside the approved list, needs to be evaluated independently for effectiveness and alignment with the overall enterprise IT strategy and digital factory vision. Teams should also be encouraged to upskill and adopt the latest technology trends.

Key pointers for tools and technology selection:

- Choose tools and technology that align with the enterprise IT strategy and will stand the test of time.
- Teams should be open to fail fast and realign quicker to adopt new tools and technologies as needed by the business.
- Pick tools that are easy to comprehend and talent availability linked to them will not be a challenge.
- Strike a balance between proven players and open-source technologies.

Reap | DevSecOps – The Investment

In simple terms, a digital factory is an integrated set of tools, services, data, and processes that enable enterprise teams to plan, build, test, adaptively release, operate, and manage software product delivery. DevOps, a cultural shift that merges operations with development, is a key constituent in the digital factory framework, and DevSecOps entrenches security into DevOps. Considering the increasingly mobile, remote workforce in the digital world with a blurring traditional corporate network boundary, DevSecOps is no more a “good-to-have” feature, but a necessity.



Security by design conveys the digital factory's intent to fully address security concerns. Security must be embedded as a core discipline in the development of every IT system in the digital factory. Traditionally, DevSecOps ensures secure and easy deployment by focusing on the faster development of a small set of the software product backlog, driving workflow improvement, and delivering value with lower operational risk. All security processes that are relevant from an enterprise perspective need to be well-defined, rolled out, monitored, and maintained as an integral part of the entire process, from the start to finish.

Golden rules for DevSecOps rollout:

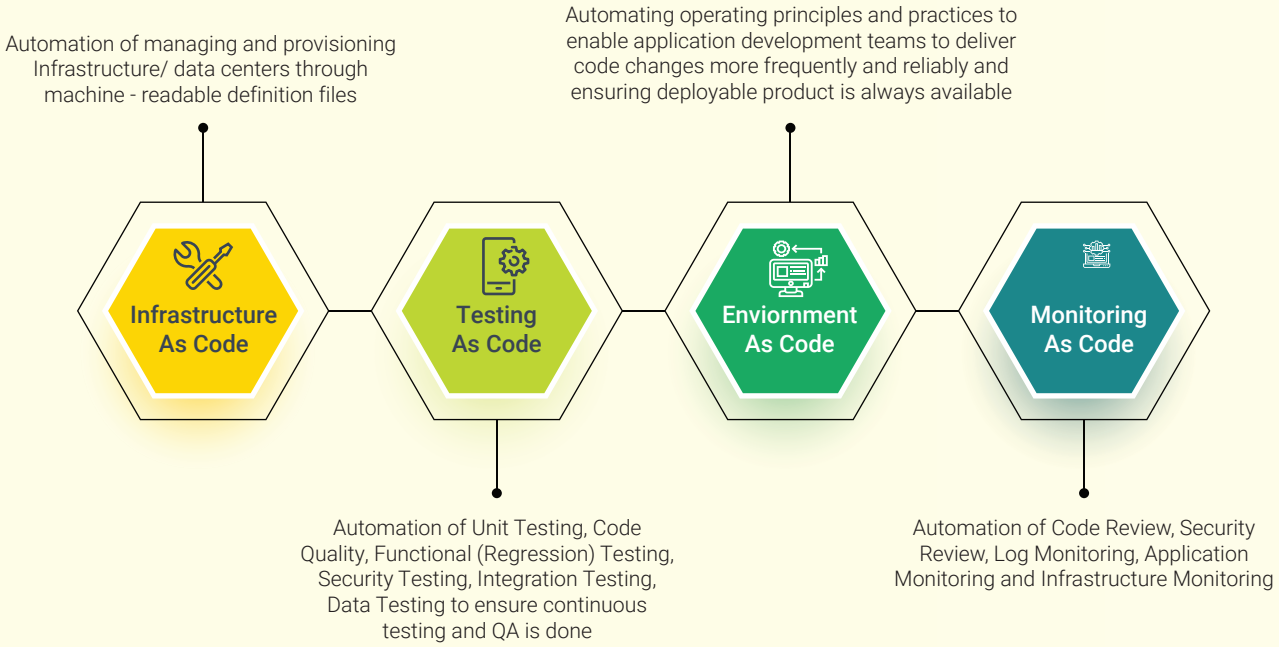
- Define multiple levels of security sensitivity index driven by a broad classification of application security. Relevant stakeholders to agree upon:
  - Methods to arrive at security sensitivity index for the enterprise
  - Security guidance and standards for each security sensitivity index
  - Different quality and security testing profiles
  - An acceptable security tolerance level established on an agreed risk-based decision table.
- Include integrated scanners and code testing and quality tools in the DevOps pipeline.
- Perform continuous compliance posture assessments and metric-based reporting.
- Automate security in setup and configuration confirmation, and place associated code and policy under secure control.
- Enhance design based on regular automated and manual audits to enable r rapid regressions in case of exposure.

DevSecOps drives predictability, consistency, reusability and many other benefits:

- Faster approvals from security teams due to better visibility into adherence to predefined project-specific standards with sensitivity-based pre-approved criteria and automation
- Improved security in the infrastructure environment, API gateway hardening, and a trusted channel for container communication with necessary controls on critical infra components
- Quicker deployment due to sensitivity-level-based templatized deployment
- Reduced attack surfaces due to automated deployment
- Holistic GRC integration for comprehensive controls
- Better security awareness and collaboration among engineering teams.

Reap | Automation – The Contraption

In general, coding simplifies problems, improving stakeholder experience and operational agility. A digital factory employs code to address operational challenges within the software development lifecycle and break down complexities into smaller manageable parts. Everything is organized and automatically controlled by software.



Infrastructure As Code

Physical and virtual machines, containers, and entire container clusters are created, updated, monitored, and managed by code by leveraging tools such as Ansible, Chef, Puppet, and Terraform. Infrastructure components and relationships between these various components are described as configurations that can be read using tools to drive results.

Code reuse offers benefits such as:

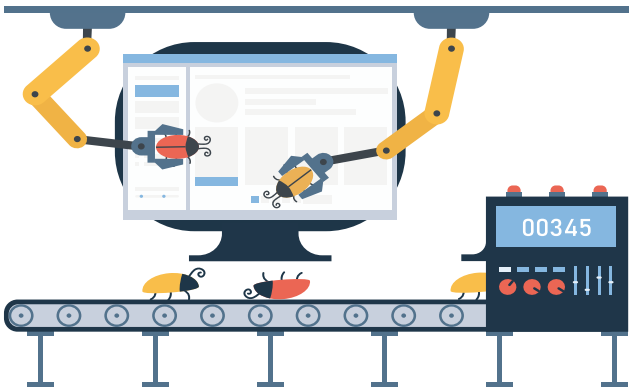
- Quicker infrastructure provisioning and configuration for development, testing, and production
- Standardized delivery due to infrastructure provisioning based on project-, software product-, platform-, and program-relevant security sensitivity index
- Ability to provide the same environment every time the same manifest is run
- Quicker rollout due to reuse of existing code snippets for infrastructure build-up
- Easy and quick provisioning of upgrades, enabling on-demand scaling.

Testing As Code

The digital factory follows the test automation pyramid strategy. Here, tests are automated at three different levels.

- **Unit testing:**
  Frontloading tests at the unit level allows quicker and easier bug fixing early on in the process. Unit tests should test one variable at a time, per commit, without relying on any external dependency, and should be part of nightly builds.

- **API, microservices, integration testing:**
  This should be CI-triggered, utilizing tools such as API Fortress, covering more features. It is critical to maintain the right balance of real and virtual devices to achieve high-quality builds for nightly regressions.



- **User interface and exploratory testing:**
  Here, real user simulation amidst conditions such as conflicting apps, call and text interruptions,network throttling, and network latency is applied, focusing on behavior-driven testing and emphasizing a cycle of interactions with well-defined outputs—delivery of working, tested software. Tools such as AutonomIQ help with citizen test case writing, autonomous test script generation, test data generation, and sprint, regression and smoke testing. These tools provide features such as test case auto -healing that help save time and drive the concept of citizen tester where anyone who intends to test can automate.

Enviornment As Code

This focuses on pipelines as code that are written, versioned, managed, and fixed as software components. The aim is to develop publishable built artifacts by plugging in code and packages from various sources and creating a repeatable application, infrastructure, and configuration deployment process. The digital factory also lays equal emphasis on “secure” environment provisioning.

- Automate and integrate security scans, with predefined security scans based on security sensitivity index.
- Make scans global so that every code change is reviewed and vulnerabilities are found at their source of creation.
- Build security scans into the developer’s workflow so that developers can find and fix vulnerabilities early, reducing vulnerabilities sent to the security team and streamlining their review.
- Have security-sensitivity-index-based filters for static application security testing (SAST) and dynamic application security testing (DAST) to reduce false positives in reports and cut down multiple rounds of reviews.
- Give developers access to SAST and DAST reports for improving the remediation process and facilitating secure coding practices.
- Identify possible vulnerabilities that can be auto-fixed and self-healed.

Monitoring As Code

In a digital factory, monitoring is incorporated in a way similar to the deployment of infrastructure as code. Its criticality concerning operational safety increases as software product complexity or enterprise size increases. Infrastructure is actively monitored, and more metrics and failures are intercepted automatically in every deployment.

Key principles of monitoring as code:

- Monitor only what matters to the enterprise.
- Map stakeholders appropriately so that the right people receive alerts.
- Review metrics regularly and employ auto-healing wherever possible.

Observe | Metrics & KPIs – The Pulse

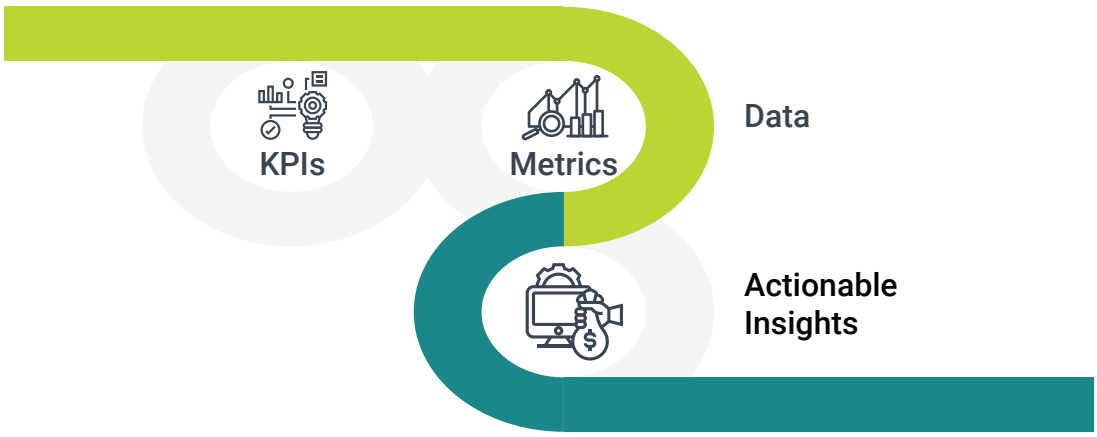
Projects can yield desired results only when a strong strategy is defined and aligned with project portfolios. Without the 'BIG' picture, it is too easy to waste time and resources on the wrong projects or assume all projects are equal and deserve the same support. It is essential to define, collect, analyze and report metrics and KPIs at the project, portfolio, and leadership level for managing project execution, meeting quality requirements, enabling continuous process improvement, and deriving inputs for goal setting.

Linking strategy and portfolios helps management teams make informed decisions, pull the plug off underperforming projects, and improve business performance. Leadership teams should emphasize focus on key strategic objectives.

This will help portfolio managers to determine what projects to execute and when and where to deploy the right resources.

The alignment of strategy and project portfolios is important, and its effectiveness needs to be measured with metrics. Leadership teams must have complete visibility into projects executed through the digital factory to facilitate fact-based informed decision-making.

While defining metrics and KPIs, the digital factory recommends value stream mapping leveraging the **SMART** framework (**S**pecific, **M**easurable, **A**ttainable, **R**elevant, and **T**imely) to validate against enterprise goals.



Top tips that can help choose metrics and KPIs:

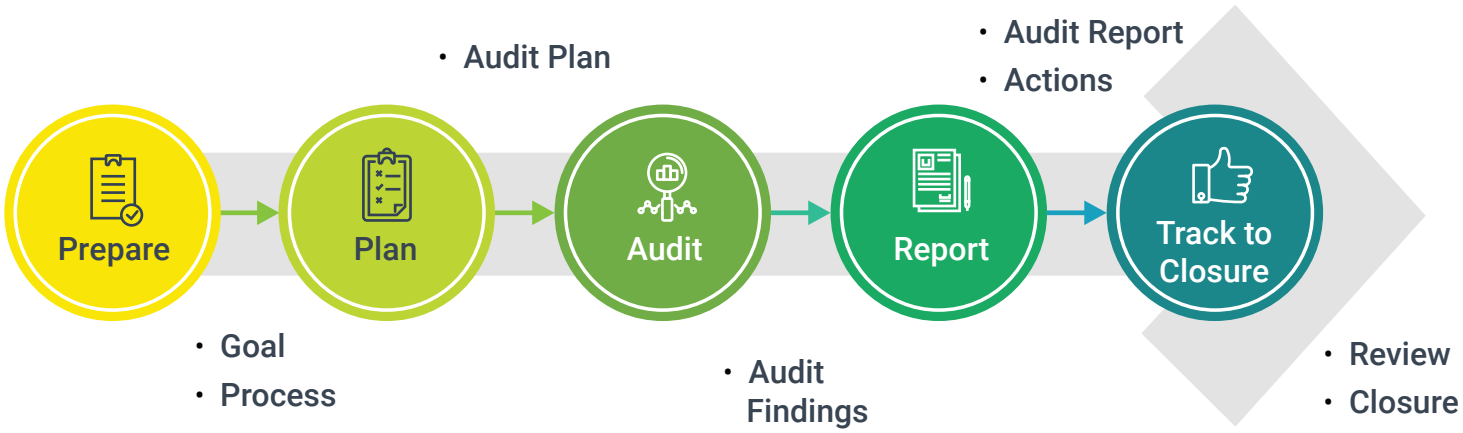
- The purpose of measurement is to improve decision-making through a better understanding of reality.
- Measure only what matters to the business or department, and if a decision or meaningful inference cannot be arrived at, drop the metric.
- Data powering metrics and KPIs needs to be accurate as insights will only be as good as the available data.
- Analytics to derive insights and meaningful metrics and KPIs can help proactively realize and mitigate risks.
- Metrics, KPIs, and insights must be readily available to relevant personas in the form of dashboards, reports, etc., through multiple channels.

Observe | Quality Audits – The Reality

A reality check at regular intervals by the quality assurance team is a must to help:

- Verify visibility and predictability of standardized project and software product delivery operations on the ground.
- Confirm that the team is aware of processes that need to be followed, and if required, guide them, help identify process gaps and pain points, and offer guidance on improving the quality of deliverables.
- Maintain adherence to processes and policies by different teams to ensure overall objectives and process compliances of the digital factory are met.
- Create awareness of non-compliance so that teams act promptly and get back on track.

Audits ensure teams are serious about adhering to defined standards and are able to reap desired benefits. All audit findings that may be linked to risks, areas of improvement, and best practices should be logged in and shared with relevant stakeholders via a centralized tracker. Risks should be followed up and tracked to closure within defined timelines.



By mapping audit findings to anticipated results defined by strategy, leadership teams can plan course correction as needed. Digitizing audit reporting with proper access control can improve transparency and collaboration within the team and enterprise.

It is also important to review the audit process and automate it—right from planning, assigning auditors, executing mundane checks, and reporting non-conformances, to auto-closing non-conformances, and collating audit results, to bring in efficiency.

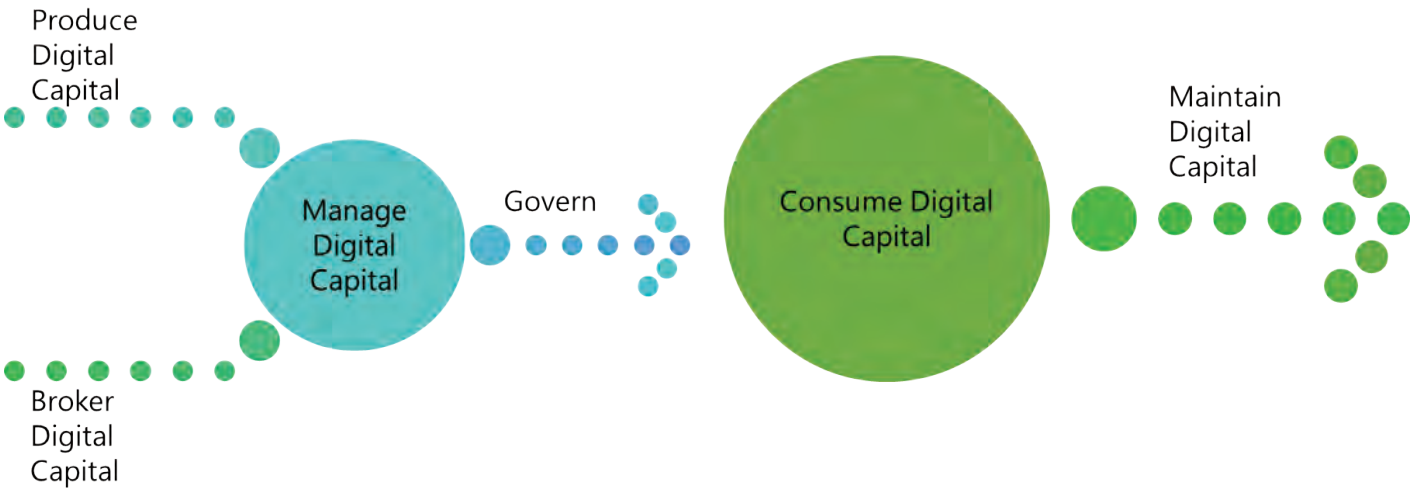
Win | Digital Capital – The Game

Digital capital—a collection of well-tested and documented software components, templates, SOPs, blueprints, reference implementation, etc., in a centralized library—encourages teams across the enterprise to use these rather than developing new ones from scratch. As new software products made from digital capital components increase, the enterprise is able to realize corresponding improvements in cost, time, and quality. Dramatic improvements are visible at a reuse level of 80% or more.

Measuring software productivity can make it difficult to quantify savings from digital capital reuse. However, inhibitors to successful systematic reuse can be overcome by improved processes, careful management, and a well-designed and packaged digital capital repository tool.

Effective reuse of digital capital can decrease software product development costs by a sustainable 10-12%. Defect rates in delivered software products can drop drastically to 10% of their former levels, and long-term maintenance costs can drop to 20%-50% of their former values when several software products share the same, high-quality components.

For digital capital adoption to be effective, enterprises must identify case-specific inhibitors and then plan to overcome them. Typical challenges include a lack of long-term commitment from the management, team members not wanting to reuse someone else's contribution due to a lack of understanding on how it can save overall time, and needless competition between departments and business units in areas where collaboration can help.



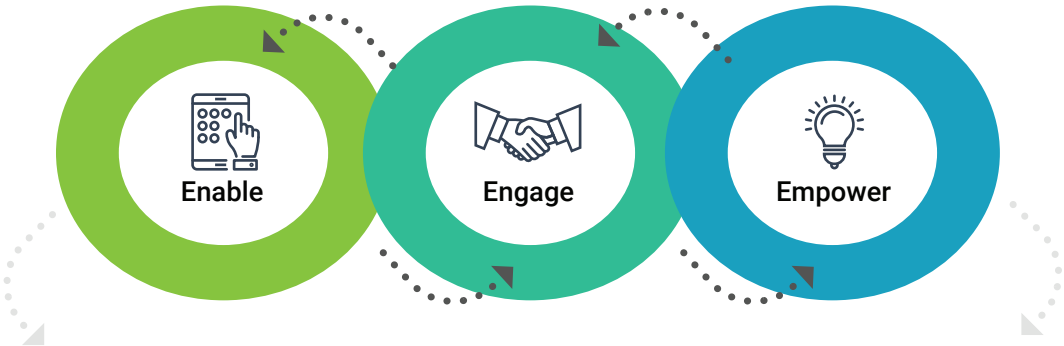
Key suggestions for driving digital capital reuse:

- Set up an enterprise-level governance team to develop the reuse process and perform tasks such as domain analysis, reuse assessment and proposal, estimation, coding guideline formulation, and identification and collation of best practices, templates, blueprints, SOPs, and other existing reus able components.

- Develop a centralized digital capital repository and create a digital capital handbook withguidelines for digital capital creation, submission, approval, maintenance, and consumption.
- Ensure digital capital is always up to date with appropriate version control and with clear descriptions for each of the components on their utilization.
- Monitor and measure value driven by reuse.
- Reward and recognize significant contributions and reuse.
- Add digital capital contribution and consumption to employee key responsibility areas (KRAs).

Win | Self-Service Factory Portal – The Podium

The self-service factory portal is a one-stop-shop that provides access, support, and knowledge for all digital factory services.



- Quality Management
- Learning Management
- Knowledge Management
- Product/ Project Management
- Thought Leadership

- Assimilation
- Collaboration & Communication
- Personalization
- Communities Forums & RSS Feeds
- Contextual Help/ Search

- Service Catalog
- Digital Capital Repository
- Tools & Technology
- Insights (Metrics & KPIs)
- Audits
- Notifications & Alerts

The self-service factory portal needs to help people deliver desired business outcomes with quality and agility, leveraging defined processes and technologies. It needs to engage people, enable them to execute their responsibilities, and empower them with the required tools to perform tasks.

Engage:

The portal needs to be attractive enough for users, with personalization to suit their way of working, and enabling collaboration and communication among stakeholders. Gamification with points, badges, and rewards for adherence to policies and processes, contributions, etc., is a great way to ensure team engagement.

Enable:

The portal provides access to a well-integrated network of management systems to enable one to understand the process (quality management system), complete required training programs (learning management system), contribute and consume knowledge in the form of blogs, whitepapers and thought leadership material (knowledge management system), and review and act upon important project activities (project management system).

Empower:

The portal also empowers users with a service catalog through which they can perform and avail of a plethora of services- calculate security sensitivity index, compute as a service, storage as a service, infrastructure as a service, upgrade as a service, database as a service, backup/restoration as a service, messaging as a service, etc.

Users should be given access to:

- Digital capital where they can contribute, search, and consume assets seamlessly
- Approved tools and technologies, associated standards, best practices, and reusable components
- A channel to request for situation-based addition/removal of specific tools or technologies
- Work-related alerts, notifications, and insights that they can act upon.

The self-service factory portal's features need to evolve with time. It should integrate people, processes, and technology to deliver an experience that engages users, enables them with the required information, and offers guidance that empowers them to deliver tasks.

Conclusion

Enterprises now realize how a digital factory can enable quicker delivery of quality software products and services. Some of the world's largest companies have set the gold standard in this space, pushing updates and releases daily to fix bugs, strengthening code, introducing new features, and handling unpredictable scaling with ease. The digital factory is a step toward agile and quality delivery.

The digital factory is all about well-functioning teams who work hard on shared goals across the enterprise employing optimized technologies, leveraging validated digital capital components, applying high-quality engineering and operational processes (automating everything possible), and applying insights to take actions.

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He has 22 plus years of experience in the Technology Industry. He provides leadership around Cloud Computing, Microservices, Enterprise Integration & Process Automation, DevSecOps, Cognitive QA, Blockchain among other innovations. He is responsible for defining the technology strategy for enterprise solutions, products and platform engineering across technology practices within Digital Business Solutions.

His expertise and interest lies in rolling out Digital Adoption initiatives leveraging niche technology platforms, driving large scale Digital Transformation to achieve Business Innovation powered by Customer Delight and Intelligent Business Operations. As a digital evangelist and thought leader, Ramu provides strategic leadership mentoring along with advising clients and articulating business scenarios with insightful knowledge of technology deployment and in defining strategic objectives of transformation.

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