

Digital Transformation

The New Oil: Refineries and Engines to Tap into this Source of Power

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Introduction to Digital Transformation

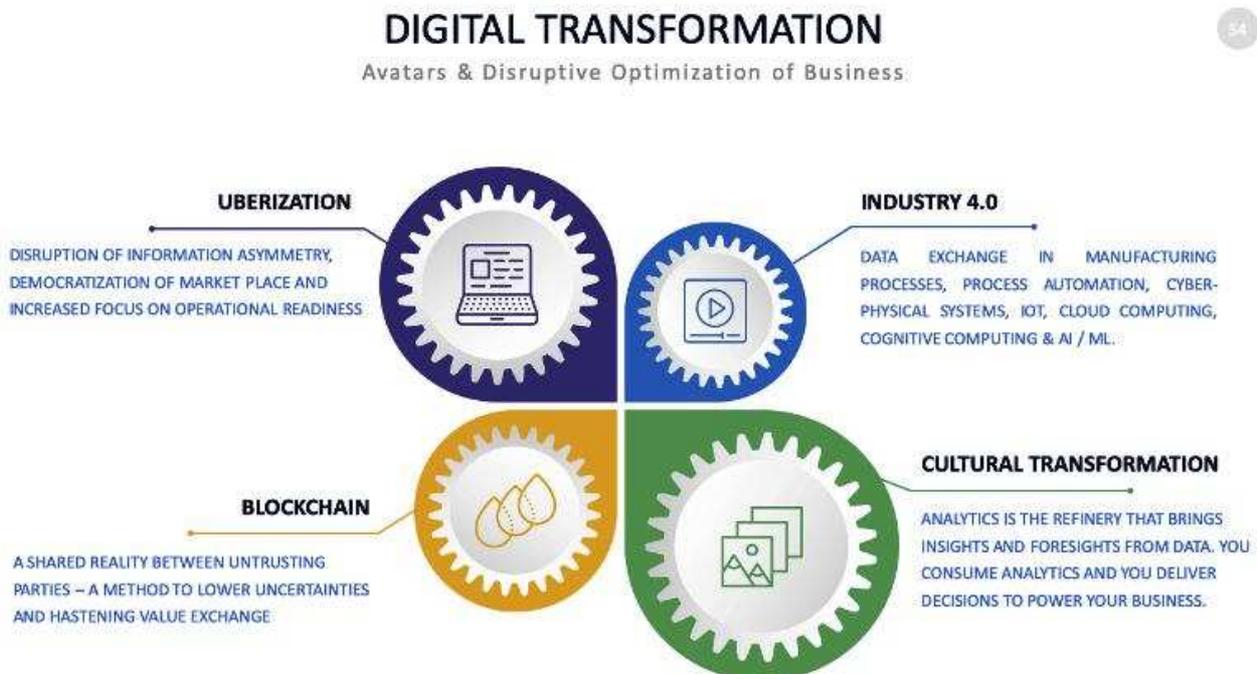
Let's start off by acknowledging that there is no unanimously accepted definition of Digital Transformation. Internet searches for a definition of Digital Transformation bring us to some common themes: reinventing business processes, bringing about a cultural change and cloud computing. This is a good enough premise to get started.

Let's get the fundamentals right and the boundaries defined:

- Why reinvent a business process? Clearly, to deliver greater value to the customer. Why? Is our customer suddenly demanding more value – Yes, they are. How? Isn't it just another phase of negotiation – No, the customer is armed with information now.
- What is the cultural change? It is the much-needed people transformation – digital fitness is becoming a mandatory section in all resumes, highlighting new set of skills needed to survive, flourish and lead businesses as data becomes ubiquitous.
- How much of it is driven by technology? IoT, Big Data, Machine Learning, Analytics, Mobility and Cloud Computing – what is the right mix of technology for success.

Digital Transformation – It's Many Avatars

Digital Transformation manifests differently in different domains. Disruption of information asymmetry, upskilling blue collar, demanding white collar to be cognitive and creative, delivering permission-less decisions, bridge islands of digitalization, Industrial Internet of Things (IIOT), Industry 4.0, Living-breathing data systems, Single Source of Truth (SSOT), Provenance of Data and more.



Let's explore some real-life transactions and see how they are being transformed:

Use Case	As-Is	To-Be
Condition Monitoring	Hourly patrol with a digitized measurement device checks vital parameters and writes in a log book. Diligence is often compromised and justified as operator instincts. Lack of reliable data makes root cause analysis a charade.	Sensors beam data to a historian server – the log. Machine learning differentiates common cause and special cause. Special causes become tickets or alerts based on severity, recurrence and time elapse.
Food Safety	Samples are picked at different stages as food moves through the supply chain to check for contamination.	GPS and Telematics generate live data about transport conditions and route. Live data streams are disintermediated into blockchains and, smart contracts enforce shipment rules.
Set up approval	At the start of a production batch, a sample quantity is produced, put through inspection, and report is approved before full scale production starts, simultaneously creating production losses.	Computer integrated manufacturing can log machine condition, production settings and product parameters. These can be transported across a network for live analytics and setup approvals and for production patrol.
Tool life cycle	Tool utilization is measured as elapse time or number of parts produced. Expensive tools may have life left behind depending on a number of correlated parameters.	Live monitoring of critical to quality product parameters can monitor and predict tool life cycles, extending utilization and also preventing defects.
Traceability	Digitalization has created data disconnected data islands. Traceability requires manual stitching together of data across process value streams, incurs time.	Lot level traceability if not piece level traceability on demand with logs compiled across process value streams and stored in big data archives.
MIS	Paper logs are data entered to spreadsheets and analyzed offline. Report generation incurs time and effort.	Industry 4.0 technologies create integration of data across manufacturing processes, use cognitive computing and deliver insights and foresights in capsules. These capsules are context specific and can be delivered in devices.
Reports	Most commonly seen as prints of logs, often accompanied by analytics capsules in the form of slides.	A Voice Assistant powered by machine learning and percolation algorithms, presents insights, foresights and trends.

While it took us twenty years in India, from our first e-commerce store to the Billion Dollar Days, we abandoned our beloved landlines for smart phones almost in a flash.

Information Asymmetry and Uberization

Information Asymmetry is when one of the two parties in a value exchange has an unfair advantage on account information that the other party does not have access to. In market place models, popularly referred to as Uberization of a business, transformation is about disruption of information asymmetry. The Digital Market place – the platform, enables democratic distribution of information bringing fairness, increase adoption and optimization to value exchange.

Let's use the most popular Digital Market Place – Hail a Cab services to take a closer look at Digital Transformation.

The consumer is now armed with data on number of cabs in the area, typical cost to reach the destination and offers from competitive providers. The provider has clues to be present at the right catchment areas at the right time. Uberization is not to be confused with market places which have existing forever, in that, market places brought competitive offers to the buyer's consideration without addressing information asymmetry. These competitive offers were often window dressed back stage.

The consumer was paying a premium for being on the wrong side of the information symmetry. As a consequence of transformation, the provider must now focus on operational efficiencies to stay relevant. Operational inefficiencies are not a mere setback, they decimate.

Trade unions that protested standardized rate structures proposed by the government, that opposed metered cabs and rickshaws have been washed over by economics – they too have been uberized. You can now get your 'bed and breakfast'

at proximity to your business location at a fraction of the price you paid your preferred 'hotel'. Customer loyalties belong, albeit fluid, to providers of information more than providers of products and services.

Where do you stay? Oyo. Where do you eat? Swiggy. How did you get here? Uber.

Data is Ubiquitous – How did We Get Here?

It all started with **Digitization**, which is, conversion of data from analog to digital bits, driven largely by electronics, for example, a digital micrometer.

It evolved into **Digitalization**, which, is transforming a business process to be conducted in a digital environment – aka, a computer, a smart phone and more recently, a voice assistant. For example, e-commerce, social media and payment gateways.

Digitization and Digitalization have been around for a while. Programmable Logic Controller and Automotive Manufacturing gave birth to PLC and the original streams of large data back in 1968. In the subsequent 40 years we kept harvesting new sources of data and woke up to data-gold being strewn all over.

Big data and blockchain, are both more than 10-years old. Computing power and the advent of affordable big data triggered large scale adoption of data driven services, revenue streams and business models.

It is now the era of **Digital Transformation**, larger in its reach than Digitalization because it includes cultural transformation. Digital Transformation touches upon most aspects of the 'People – Process – Technology' matrix.

Often, when business leaders talk of Digitalization and Digital Goals, they are referring to Digital Transformation.

Machine Learning & Workforce Transformation

It is said, the so-called golden era, of the evolution of Artificial Intelligence ended as early as 1974. Dialing back a decade or two, many anticipated that AI and robots would be common sight by 2020. In reality, we have some fuzzy logic in our washing machines, some dishwashers have sensors, some cars know how to stay the track, robots can pick and place, machines are getting better at understanding natural language. It seems, AI is not here as promised!

Whereas, Machine Learning, a subset of AI is more accessible and is an active ingredient in Digital Transformation of business. ML can be often seen as hardware and software working in tandem. ML is the ability to receive varying sets of data, and have adaptive algorithms that can continue to make sense of changes in the process. A lot of what we see as AI today comes down to Machine Learning. And, Machine Learning sets the stage of next gen Artificial Intelligence. More than technology, people, more than ever before, are getting ready for AI.

In Machine Learning, the role of a blue collar is transformed from, being a monitor of processes and transporter of data to, an agent of permission-less decision making. Let's look at monitoring in the context of Machine Learning in greater detail.

Google has defined monitoring, in the context of DevOps, to comprise of and operate in three layers: event logs, tickets and alerts. Logs are evidences of functioning of a process, a ticket pertains to an abnormality that does not warrant immediate corrective action whereas, abnormalities that need instant interventions are alerts. These three layers of monitoring are relevant for all kinds of monitoring – from traffic to production, quality and financial markets.

System	Log	Ticket	Alert
Traffic Control	Constable's daily report back at the station	Riders found without helmets	5-car pile-up during peak hour at an arterial route
Quality Control	Inspection check sheets or a log book	In process: Parameter outside of control limits	Critical to Quality parameter is unstable

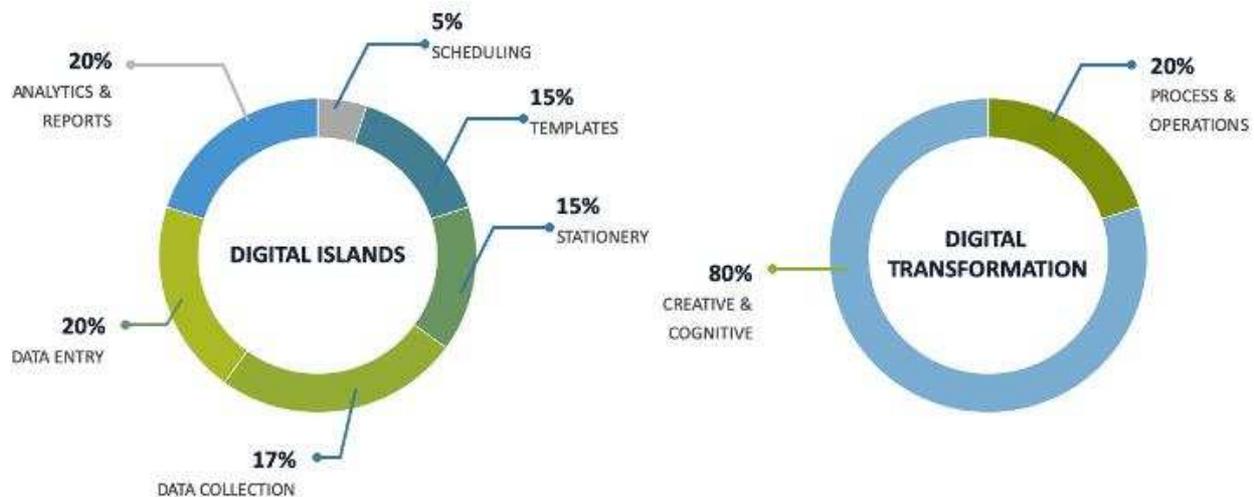
As-Is: Monitoring is manual, bets on human diligence and reliability of data output is questionable. Ticket generation is often a random exercise and driven by personal judgement. Inspectors may not have statistically validated attribute agreement and measurement systems may not comply with repeatability and reproducibility standards. Alerts are after the fact escalations, and for many firefighting has become business as usual.

To-Be: The log book in monitoring is automatically generated. Machine Learning generates the tickets and Workflow automation brings in an escalation matrix and throws up alerts.

Operators are not required to monitor machines and bring an hourly log of time and temperature data to a supervisor. Telemetry would do that. Connected cameras generate data driven alerts to transform traffic policing, making it more impersonal and smarter.

Workflow automation also delivers an additional benefit by diminishing the ‘arbitrary’ in favor of standardization and bringing up exciting possibilities of permission-less decision making. Workforce is now upskilled to decision making and is comforted in the fact that Machine Learning can reliably differentiate a given data pattern as a ticket or an alert.

Creative, Cognitive White Collar, Featuring AI



A consequence of partial Digitalization, data underlying process value streams exist as disconnected islands. 80% of a manager’s time could be consumed by process and data life cycle, leaving the manager 20% of time to apply creative – cognitive capabilities to deliver improvements.

Through Digital Transformation, machine learning, business process automation, an empowered blue collar is freeing up white collar space. White collar has to move from processes and operations to creative and cognitive. White collar has to start forging partnership with Artificial Intelligence. AI engines will be diligently learning from white collar, can white collar make it vice versa. If yes, that would be the beginning of our evolution to stay relevant in the era of Artificial Intelligence. This journey of transformation can take after e-commerce adoption – 20 years, or the smart phone adoption – in a flash.

In the end, these transformations are less about technology and more about us – the people. How successful your enterprise Digital Transformation lies in how People transform themselves.

Data is the new oil. Amongst arguments against this analogy, we should see there is a deeper context. Like oil, data is crude, it needs to be refined to become information, knowledge (insight) and wisdom (foresight). Refined oil, a source of energy, is only as efficient as the engine that consumes it. Refined data can become a source of energy only for a Digitally Transformed human mind.

Analytics is the refinery that brings insights and foresights from data. You consume analytics and you deliver decisions to power your business. The big story of machines taking over turns out to be about people.

Industry 4.0

Industry 4.0 by definition, encompasses data exchange in manufacturing processes, process automation, cyber-physical systems, the internet of things (IoT), cloud computing, cognitive computing and artificial intelligence. In terms of multi-disciplinary uptakes and scope Industry 4.0 could be among the biggest Digital Transformation exercise taken on to-date.

The biggest challenge for Industry 4.0 is pre-existing sources of digital data in our value streams. Manufacturing value streams are characterized by:

- Human Machine Interfaces that impose restrictions on network-based data transfer,

- Analog measurement systems,
- Non-standard production design across value streams delivering similar output,
- Dearth of network infrastructure – WLAN or Internet connectivity
- State of edge computing devices
- General misgivings about hosted servers and cloud computing

It is impractical to aim for complete transition from islands of digitalization to 100% Digital Factory. Unlocking all your machines to transmit condition monitoring streams, tagging all your process parameters to sensors, telemetric capabilities, IoT enablement of all your measurement systems takes budgets, effort and time. Digital Transformation can be a long road, all the more because it involves people transformation more than any other aspect of business.

While, Digital Transformation can be taken up step-by-step, some ingredients are time critical and foundational:

- Data in your value stream is your asset, when you make investment decisions, choose products or services that do not entail additional costs for data access. This a surprisingly common industry practice that leaves a value stream with islands of data. Integration of data streams becomes a challenge.
- Verify if machines adhere to industry standards such as MT Connect – these standards ensure that data access is seamless. MT Connect, for example, enables data transfer from machines using a standard network port and supports TCP/IP, not very different from our standard internet connectivity.
- Ensure your value stream has a sturdy network (WLAN) provision – this forms the backbone of your Digital Transformation. With a backbone in place, old assets can be digitalized and new IIOT assets added with ease.
- Take informed decisions towards cloud computing – specifically, work through notions that data stored locally is somehow more secure than use of cloud services. Resistance to cloud computing adds to costs of digital transformation.
- Before investing in analytics products, take stock of your databases – any analytics engine is only as good as the database that it feeds into
- Analytics projects are like banyan trees – as against crotons that can live in constrained spaces. Success of analytics is characterized by evolving scope, in terms of more data points, expanding user base and user driven need for new data models and visualization.
- When you set goals for Digital Transformation, ask this important question: Are our expectations of Industry 4.0 appropriately calibrated: is it going to be like e-commerce adoption of many years or is it going to be like smart phone rapid adoption?

Modular nature of enterprise IT systems allow for Industry 4.0 to be a step-by-step exercise in transformation, akin to physical fitness. The first step of course is becoming paperless.

Paperless Transformation is a No Brainer

Going Paperless is a fair trade off between current state and 100% Digital Factory. Paperless is a good first step towards complete Digital Transformation and is soaked in the reality of pre-existing investments in analog devices.

Most manufacturing value streams are on an unhealthy diet of paper, there are check sheets, log books, printed reports all piling into archives that block seamless flow of a business process. Paper sheets are born as templates, crawl around as stock stationery, walk around as check sheets, grow into log books, graduates to spreadsheets, go through analytics, become slides, are printed again as posters, live in a record room for many years waiting for traceability. Fully loaded, an A4 sheet equivalent could incur INR 1000 as total life time costs.

A mid-sized value stream could consume:

- Push managers against cognitive and creative into processes and operations
- Keeps businesses firefighting as against continuous improvement
- Incur a person month of effort in data management each calendar month
- Create delays when traceability is needed for after sales support and warranty

Part service warranties, Automotive recall and the larger tightening up of warranty laws mean new components of risk. OEMs and large-scale manufacturing companies are rolling out risk mitigation strategies, wherein Tier 1, Tier 2 and Tier 3 suppliers are required to support evidences and traceability requirements. A paper-based environment does not support reliable – immutable evidences of quality and makes traceability a pain. Whereas, a paperless environment enforces adherence to standard operating procedures and collapses time and effort needed to support traceability.

Paperless transformation as step-1 can deliver key benefits including:

- Transform quality functions from generators to consumers of data
- Shifts focus from inspection to continuous improvement
- Elimination if not eradication of non-value adding activities around data management

- Enforce time value of data, improve reliability
- Support business process automation

Paperless transformation and upskilling workforce are both key result areas of Sustainable business practices. If you are in exports, especially into Europe, your customer is likely to look out for and appreciate Sustainability ingrained in your business culture.

Blockchain

Blockchain, the technology behind crypto currencies such as bitcoin, is powering digital transformation in its enterprise avatar. Blockchain brings about disruptive optimization of enterprise business processes – especially those that involve highly distributed value streams. Blockchain creates a shared reality between *untrusting* parties – a method to lower uncertainties and hastening value exchange.

It is here that blockchain stands differentiated from ecommerce market places. In market places, the value exchange is still between the provider of the market place such as eBay and a buyer, whereas, in Blockchain, technology enables value exchange between untrusting parties.

In Governance, Blockchains will accelerate collapse of institutions and enforcements. The land registry of the future will not be a government department but a blockchain. Blockchain is emerging as a technological institution that will push human intervention (reference to permission-less decision making) to the edges.

Blockchain is a distributed database that will have its tentacles into pre-existing information systems such as ERP, CRM, supply chain management, and payments bank among others. Blockchain architecture delivers these key benefits:

- Transactions are securely encrypted and replicated across many computers in multiple copies of a ‘ledger’.
- Transactions approved by Smart Contracts are held together as chains: For example, an order for monthly fulfilment is connected to the annualised purchase order, price, budget approvals, supplier’s quality control, shipment tracking, through to gate pass, incoming material approval, good receipt, invoice and payable. These chains of commands are defined as Smart Contracts and cannot be broken. Reconciliations are inbuilt and ingrained.
- Completed transactions become blocks and are committed to the chain – they become immutable. To make changes to a completed transaction, one does not go back and edit a block, instead we create a new transaction as an update.
- Owing to the architecture, once data is written it becomes nearly impossible to change, making it a very secure system for storing digital assets (value).
- A blockchain might be implemented publicly, within a consortium of participating partners, or as an enterprise solution within a single organisation acting as a custodian.

Technologically, much of what blockchain brings to the table has already been in use: data clusters, replication, rule engines, interfaces with different data structures, application interfaces have all been in use for many years. Innovation in blockchain distills down to its capabilities as a distributed database – ledger system that has enviable performance capabilities and, its highly secure encryption. Much of the Digital Transformation brought about by adaptation of blockchains is the how we do business.

Smart contracts are computer programs that can execute business contracts. In essence, they monitor and derive data points from pre-existing information systems. Rules respond to events and trigger successive events. Smart Contracts create secure records and can be built to support third party verification.

For example, a Smart Contract for vendor payment may be visualized as follows

- Supplier side pre-dispatch inspection certificate creates a shipment notification
- Logistics partner responds by sending a truck to pick up the shipment
- Customer responds by getting ready for incoming inspection
- Digital gate pass permits entry of shipment at a stipulated time at the right location
- Incoming inspection clears the lot
- Good received note is issued
- Supplier generates invoice
- Payable is created in the system

Here is a “Hello World” rendition of Smart Contract from Solidity, an open source program to author and run Smart Contracts for enterprise blockchains:

```

pragma solidity ^0.4.16;

contract HelloWorld {

    uint256 counter = 5; //state variable we assigned earlier
    address owner = msg.sender; //set owner as msg.sender

    function add() public { //increases counter by 1
        counter++;
    }

    function subtract() public { //decreases counter by 1
        counter--;
    }

    function getCounter() public constant returns (uint256) {
        return counter;
    }

    function kill() public { //self-destruct function,
        if(msg.sender == owner) {
            selfdestruct(owner);
        }
    }
}

```

End Note

This article is written from a practitioner's point of view. Digital Transformation is not an "if" or a "when." It is NOW. It is enchanting to see how large and small enterprises are thriving and succumbing to different Digital Transformation initiatives. It is not about size. It definitely is not about technology. If there is just one take away, focus on people and cultural transformation and do not make it yet another exercise of fancy nomenclature and Information Technology fads.

About the author



Venkat Krishna is the Principal Consultant – Digital Transformation & Analytics, and co-founder of PQSI Digital Private Limited.

Before founding PQSI Digital, I have worked with and, co-founded IT services companies in areas such as ERP, CRM, Global Outsourcing, eCommerce, Content Management, Machine Learning, Analytics, Service Excellence, Backoffice and Education. I have been IT partner – Transformation agent to many a startup and had a worm's eye view of many failures and the rare success.

In the last 4 years I have transitioned to be a specialist in Digital Transformation for Manufacturing companies and have delivered over 35 blueprints for a variety of manufacturing value streams: Ashok Leyland, CEAT, Pidilite, Murugappa Group, Rane Group, TVS Group, Ministry of Defence and a multitude of MSMEs. I also had the privilege of building a Blockchain blueprint for disruptive optimization of bill of exchange for Ashok Leyland.

At PQSI Digital, we deliver Industry 4.0 – Analytics for Manufacturing with practice areas comprising Edge Computing, IIOT, Big Data, Machine Learning, Analytics, Statistical Process Control, One Touch Dashboards and Mobile Apps.

What is Gig Economy: A gig economy is a free market system in which temporary positions are common and organizations contract with independent workers for short-term engagements. The term "gig" is a slang word meaning "a job for a specified period of time" and is typically used in referring to musicians. Examples of gig employees in the workforce could include freelancers, independent contractors, project-based workers and temporary or part-time hires. More at <https://whatis.techtarget.com/definition/gig-economy>

What is 6G: 6G (sixth-generation wireless) is the successor to 5G cellular technology -- 6G networks will be able to use higher frequencies than 5G networks and provide substantially higher capacity and much lower latency. One of the goals of the 6G Internet will be to support one micro-second latency communications, representing 1,000 times faster -- or 1/1000th the latency -- than one millisecond throughput. More at <https://searchnetworking.techtarget.com/definition/6G>