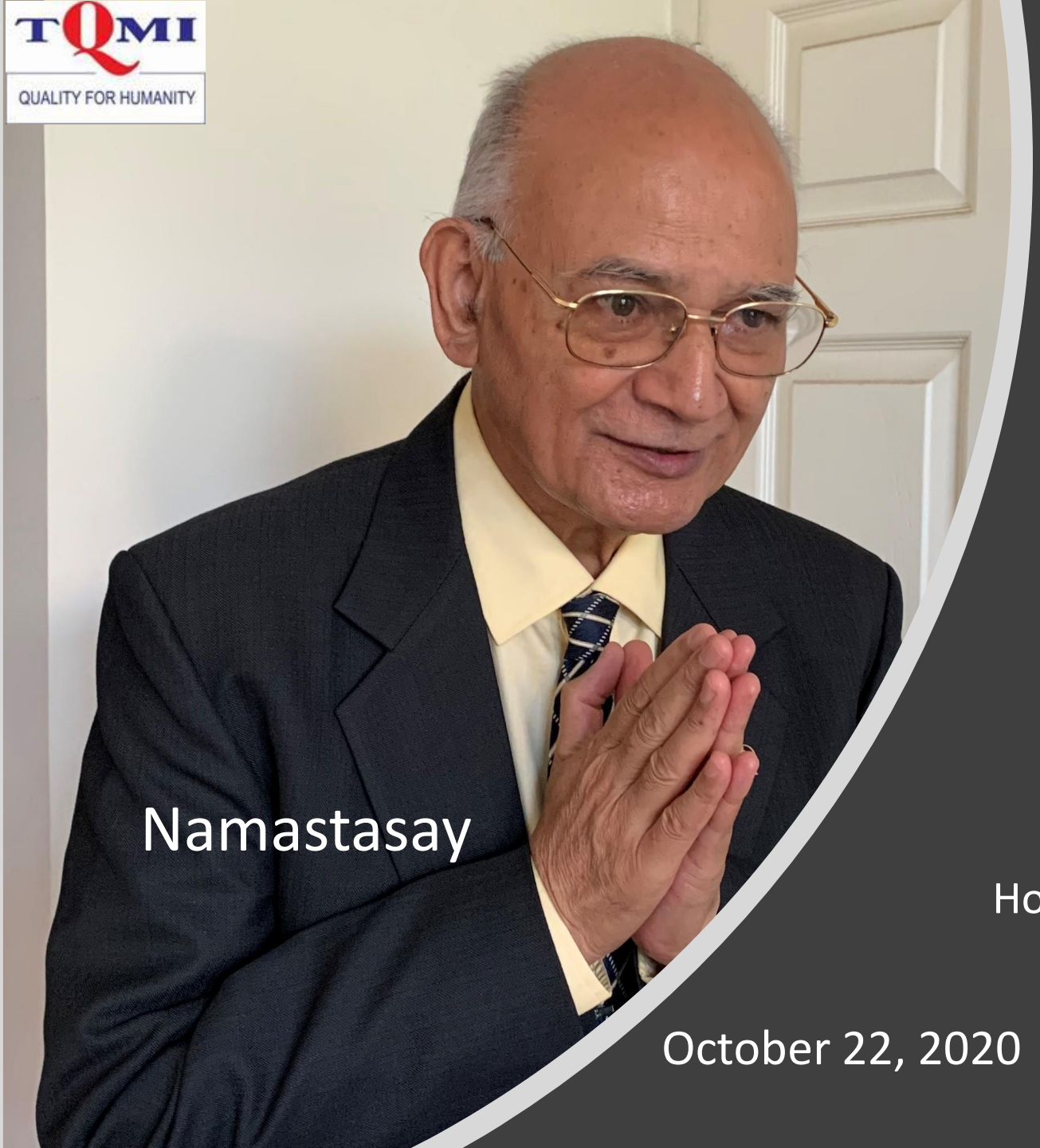


ANQ Congress 2020, Seoul

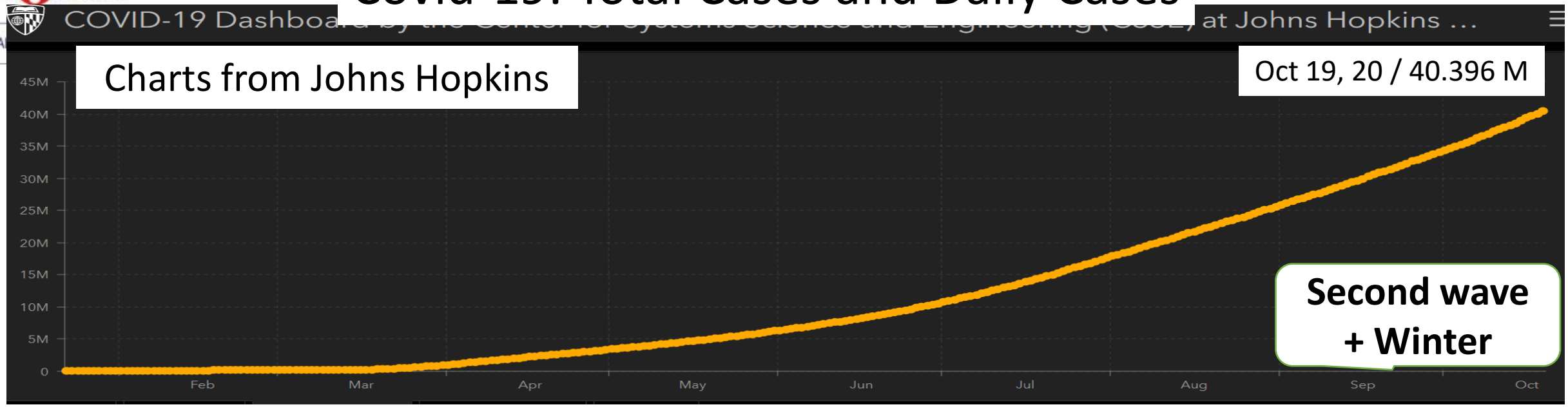
Plenary Session I: Theme - Worldwide Quality Strategies after COVID 19

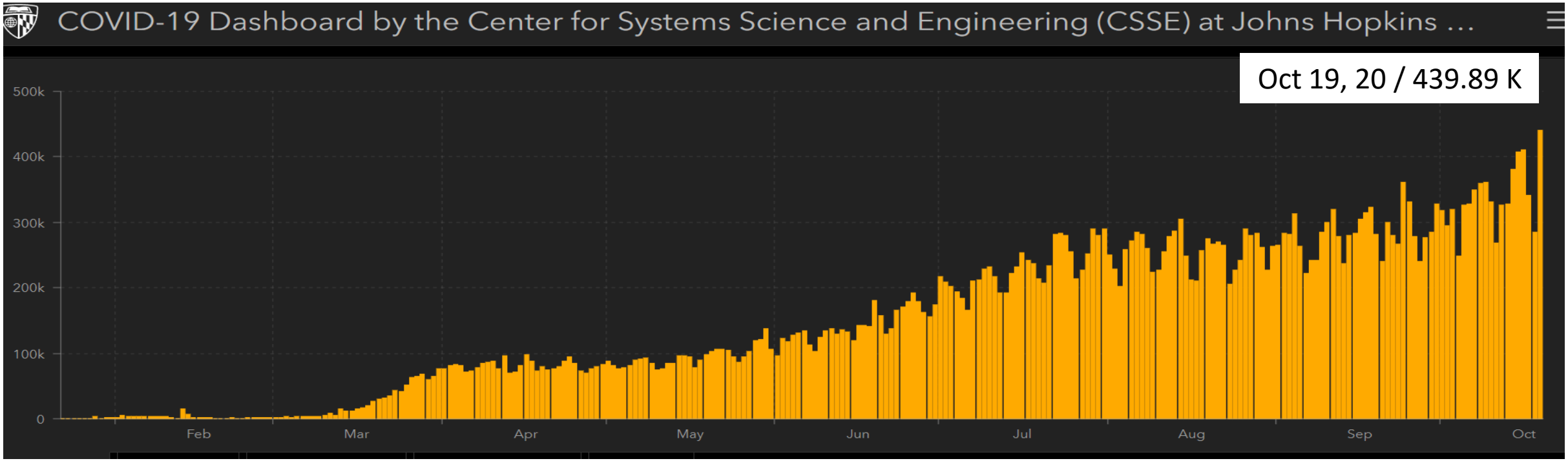
Topic: COVID-19 and its impact on business and quality

Janak Mehta
Chairman TQM International Pvt Ltd.
Honorary Director ANQ & Chair ANQ IKA Committee
Chairman Intangles Lab Pvt. Ltd.
Honorary Member & Former President – IAQ
Founding President – Indian Society for Quality

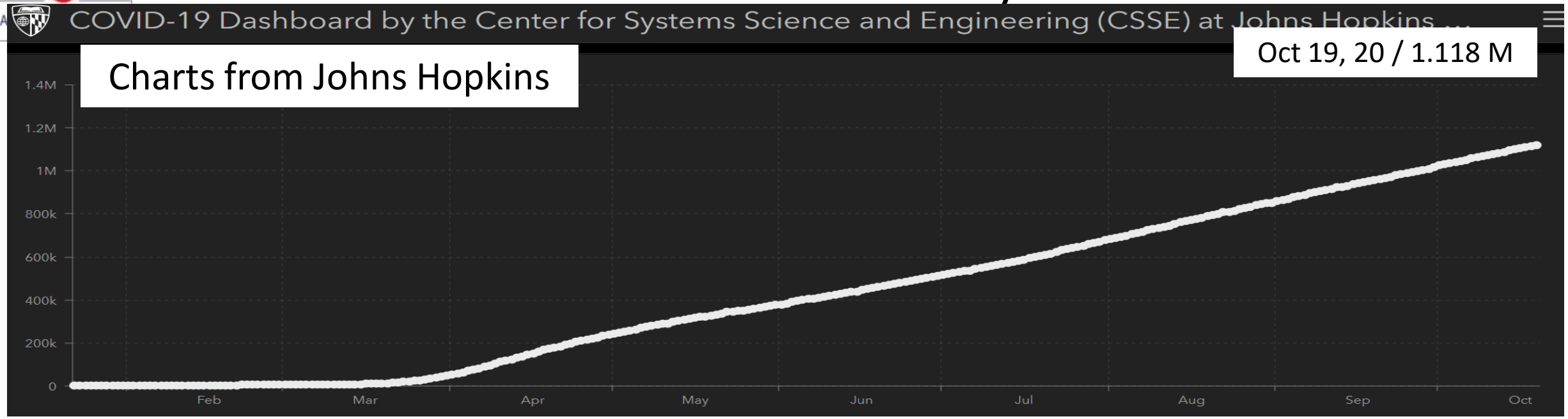
October 22, 2020

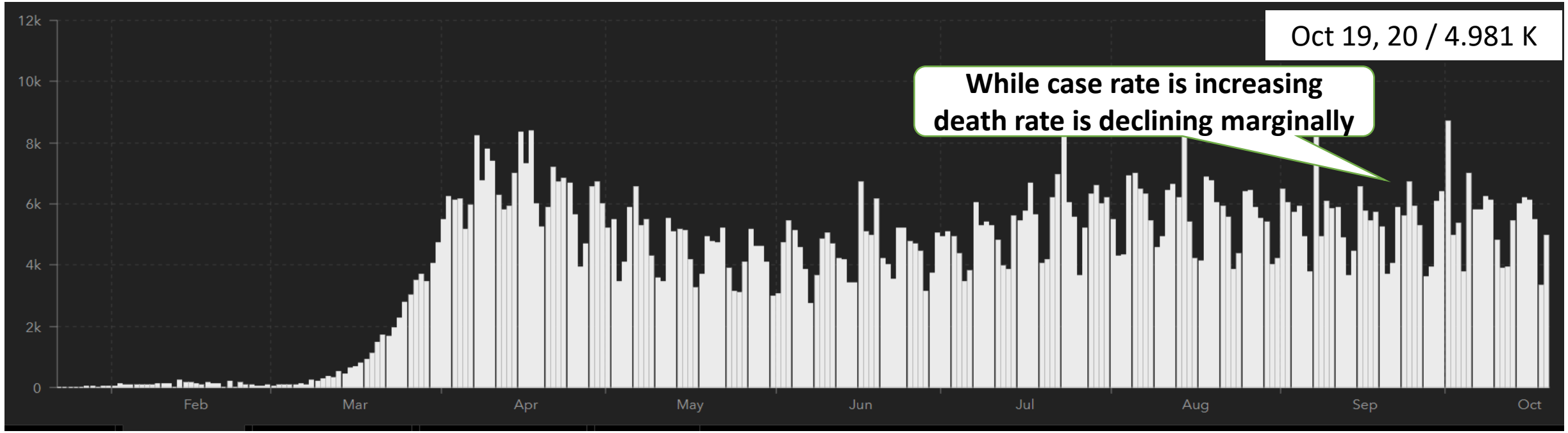
Covid-19: Total Cases and Daily Cases





Covid-19: Total Deaths and Daily Deaths





Tomorrow's organization may be different from the past

Hallmarks of an organization designed for speed

Fit for purpose operating model…

- **Flatter** organizations with much less hierarchy and streamlined decision rights
- **Faster** information flows and decision-making, powered by embedded data and analytics
- **Cross-functional teams** collaborating to tackle common missions through test-and-learn approach
- **Flexible** ways of working, including affinity for hybrid remote/in-person teams
- **Dynamic** allocation of talent deployed against mission- critical priorities
- **Agile, resilient talent** able to move fast, adapt to change and continuously learn

…with improved outcomes

- **Faster speed to market**: first to act on market trends, customer needs, talent acquisition
- **Increased customer responsiveness**: 6-10x increase in testing throughput, 50-200% reduction in time to launch new customer experiences
- **Greater efficiency** and return on invested capital
- Stronger **performance orientation** & **employee satisfaction**

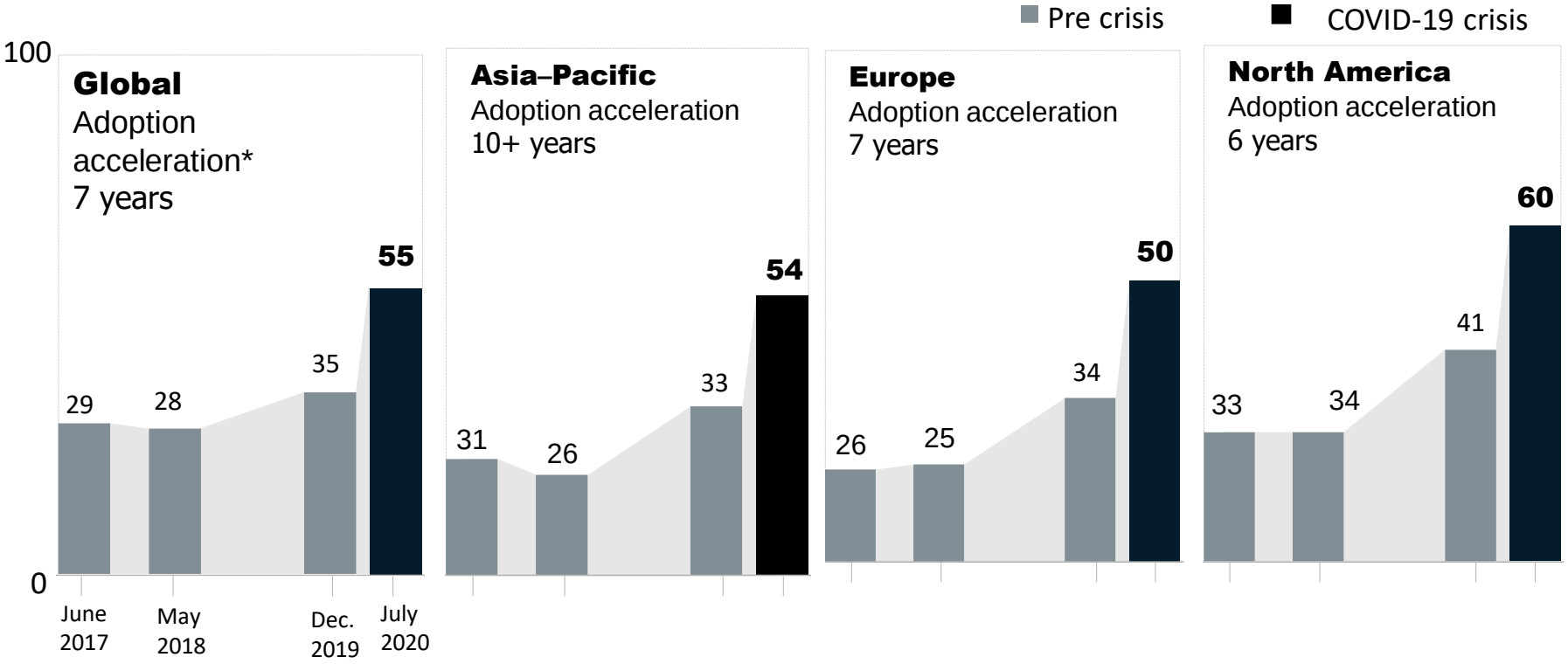
How COVID-19 has pushed companies over the technology tipping point—and transformed business forever – Survey concluded 30 July 2020

McKinsey & Company [4]

Exhibit 2

Across business areas, the largest leap in digitization is the share of offerings that are digital in nature.

Average share of products and/or services that are partially or fully digitized, %



*Years ahead of the average rate of adoption from 2017 to 2019.

Key Points

1. Technology is driving the change enabling speed, accuracy and agility.
2. Organizations are questioning the slow speed of change that preceded Covid-19.
3. Technology is enabling real time data in large quantities, more accurately with much less human effort.
4. Analytics and machine learning makes it possible to provide possible solutions that could be validated in parallel with much shorter time.
5. Every engineer / manager is expected to achieve stated objectives with the help of technology. He / She has imbibed the science of quality engineering and industrial engineering.

Way forward for Quality Professional

Show relevance by effectively contributing to:

1. Reliability of data being collected. Big challenge in most companies.
2. Domain / process knowledge at Gemba and facilitation through soft skills
3. Continual improvement using PDCA / Six Sigma approach with appropriate use of SQC
4. Visualization and communication skills to relate improvement in easy to understand story format.
5. Better understanding of IT needs and modelling for effective interface.

Experience Sharing

Leveraging Technology

2. ICT Business Unit of TQMI: Use of ICT for quality management within the company for QCDSM improvement

2. **Quality 4.0 Using IOT & Analytics. Products:**
A. **4E** for effective deployment of daily management & policy management
B. **QA Matrix** for quality & process efficiency improvement

3.3 **B: Logistics:** Improve logistics efficiency and cost using digital technology

3.1. Intangles: Largest automotive Digital Twin & machine learning company in India.

3.2 S: BEE ESCO empaneled energy efficiency company using IOT & analytics

1. TQMI Consulting Business in Quality Management

1. Establish foundation of customer oriented, quality focused, fact based culture (5W & 1H of data)

3.1,3.2, 3.3: Associate companies that carry out projects for specific requirements of TQMI clients on behalf of and in cooperation with TQMI using specialised digital approaches developed by them.

TQMI
QUALITY FOR HUMANITY

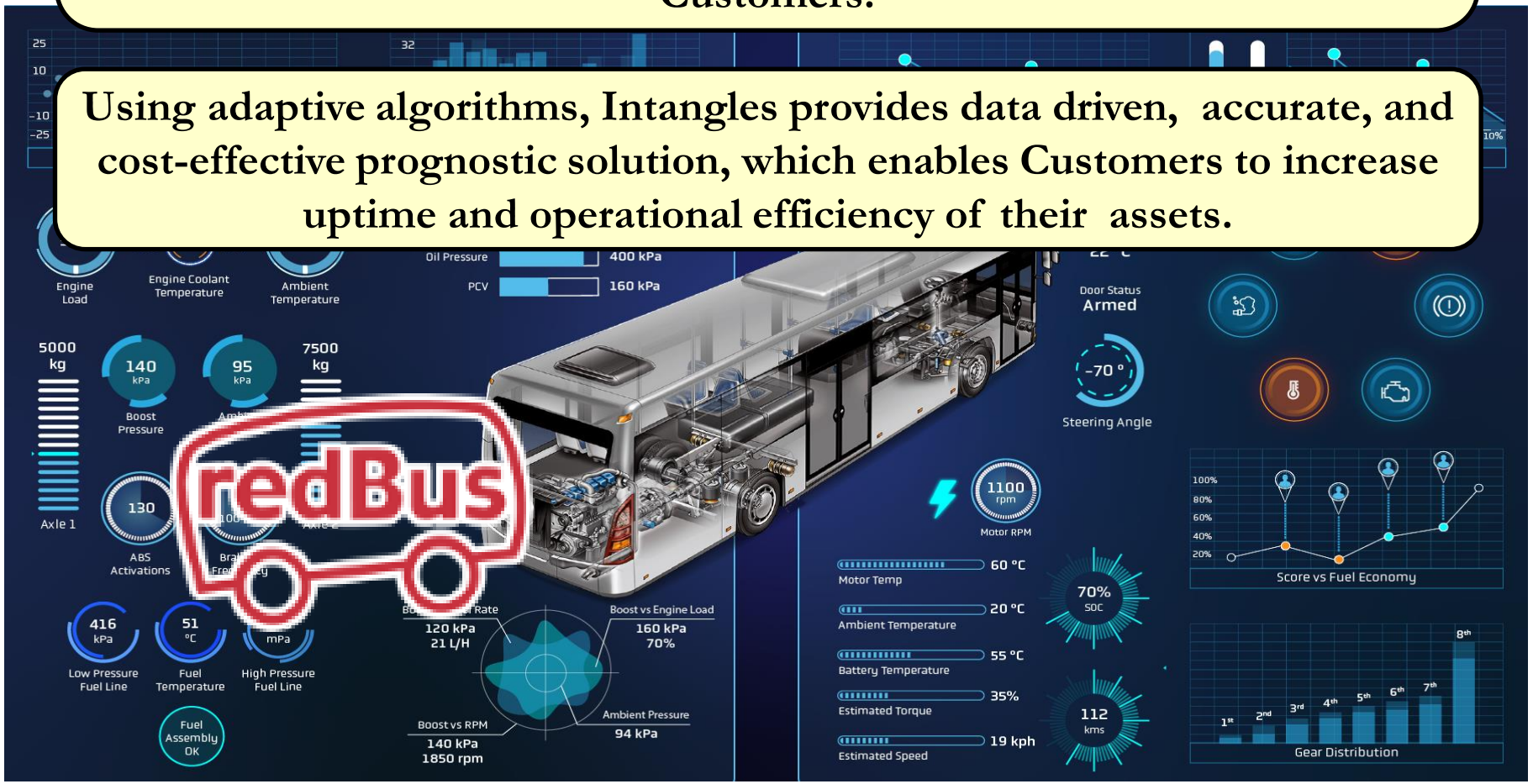
4E – Empowering Employees for Effectiveness & Efficiency

Intangles: Advanced predictive solutions company using "Digital Twin" for the mobility industry

INTANGLES
A DIGITAL TWIN COMPANY

Used Digital Twin to provide solutions in the mobility space using physics-based analytics and machine learning to mine data streams, deriving actionable insights and KPI centric business value for its Customers.

Using adaptive algorithms, Intangles provides data driven, accurate, and cost-effective prognostic solution, which enables Customers to increase uptime and operational efficiency of their assets.



Key Operating Metrics

9,318 # of devices (FY20E)	**320M** # of data points per day
1.2M # kilometers tracked/day	**7.08M** # litres of fuel tracked/month

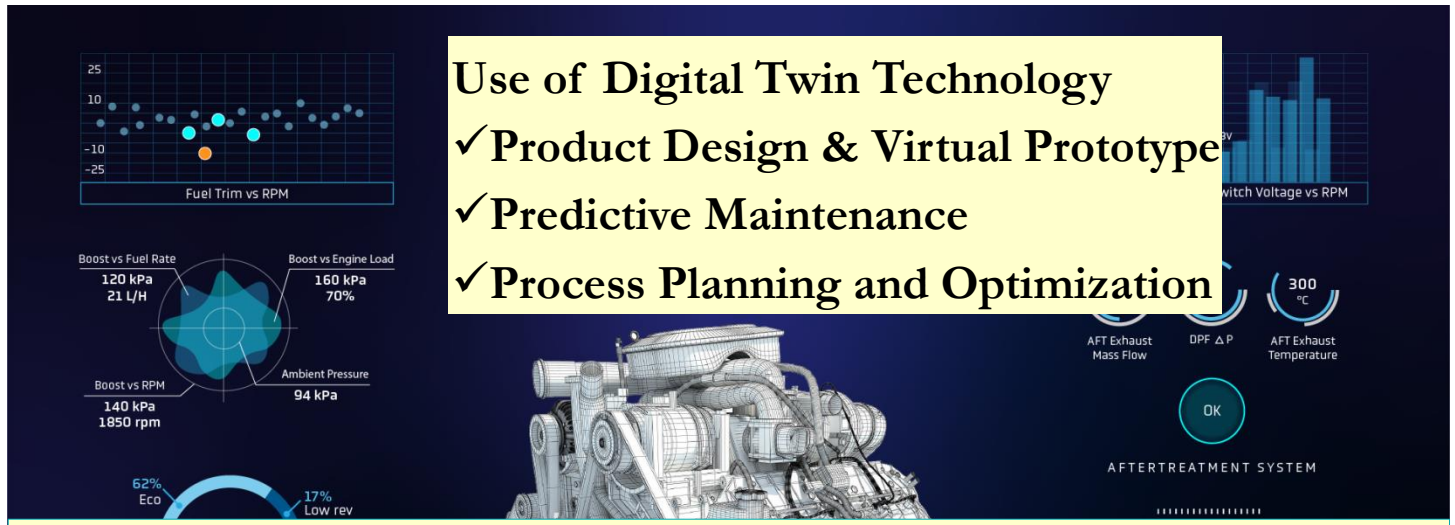
Key Technologies	Solutions Provided
Vendor Neutral Interface	Component Level Predictive Insights
Hybrid Compute Platform	Fluid Pilferage Mining
Physical + Digital	Fleet Efficiency Analytics
AI & ML Statistical Inferencing	Geospatial Intelligence

Marquee Clientele & Partnerships

Mahindra, GREAVES SINCE 1859, redBus, BP, intel, PRAXAIR Making our planet more productive

Digital Twin foreshadowing telematics in the mobility industry

Introduction to Digital Twin Technology



Use of Digital Twin Technology

- ✓**Product Design & Virtual Prototype**
- ✓**Predictive Maintenance**
- ✓**Process Planning and Optimization**

What is a Digital Twin → A digital twin is the combination of a computational model and a real-world system, designed to monitor, control and optimize its functionality. Through data and feedback, both simulated and real, a digital twin can develop capacities for autonomy and to learn from and reason about its environment.

Evolution of Digital Twin Technology → Promoted by companies such as GE, Siemens to create digital replicas of machinery operating in remote areas such as Windmill, Turbine, etc.

Why Digital Twin?

Subject Matter expertise at your fingertips

Evolution of auto industry → more sophisticated design of Powertrains

+

Limited roadside assistance for drive-by-wire engines

Sending the Vehicle to a service station for minor instrumentation faults indicated on the dashboard → **Not economical**

Prognostics, Not Diagnostics

Use of Digital Twin Technology

Prediction → Digital twin simulates component as multi- dimensional data models. Quantifiable features on wear and tear derived from said models, mapped against a diverse, highly representative population with similar specifications, generating predictive insights.

Component level analysis → Digital twin enables a continuously learning virtual sensor for each system → identifies sub-system level failure modes.

Turbocharger

- ✓ One of the mo… (turbocharger, intercooler, air filter).
- ✓ All high-perfor… power and fuel economy
- ✓ Intangles build… *ke manifold Air Pressure)* with RPM and engine load in …

✓ **Intangles builds a 3D regression model for executing outlier analysis & maps boost pressure in the intake manifold of engine *(IMAP – Intake manifold Air Pressure)* with RPM and engine load in normal distribution**

Good Turbocharger

- ✓ Intangles algorithm leverages the population of similar platforms (Volvo D11C engines) and continuously learns the boost pressure for a mean representative vehicle (~200 kPa @ 1300rpm and 100% load)

Bad Turbocharger

- ✓ For this instance, maximum compression is limited to 144 kPa @ ~1300 rpm and similar engine load (~100%) coordinates

Result

3.3

18%

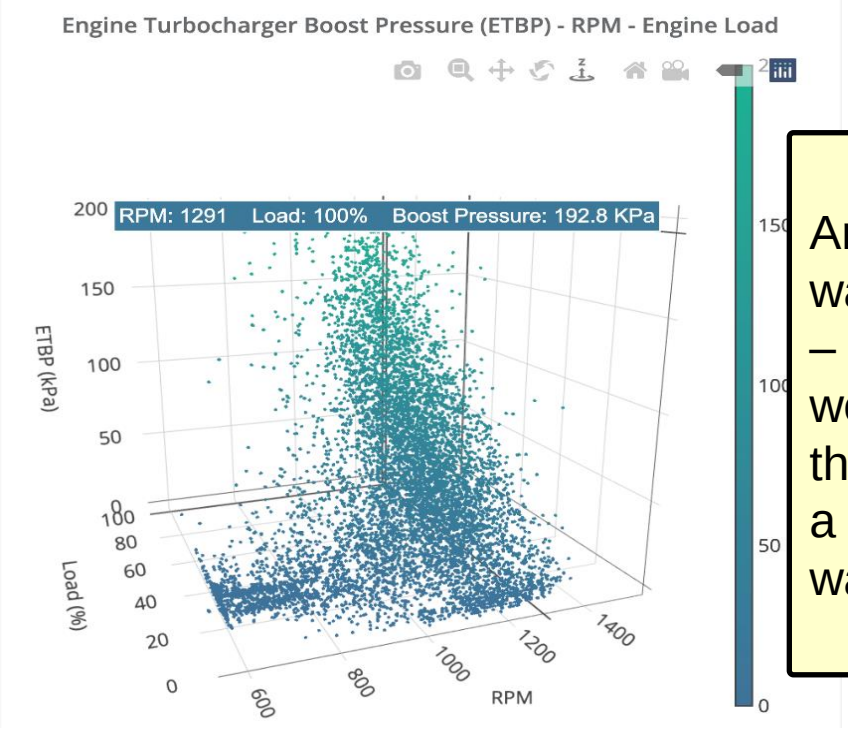
Post repair, Power output of engine improved …uel economy …roved from … kmpl to 3.3 …l.

…et for fuel …ovement for …or is ~ 1-2% …pair, …d deliver an …t of ~18%

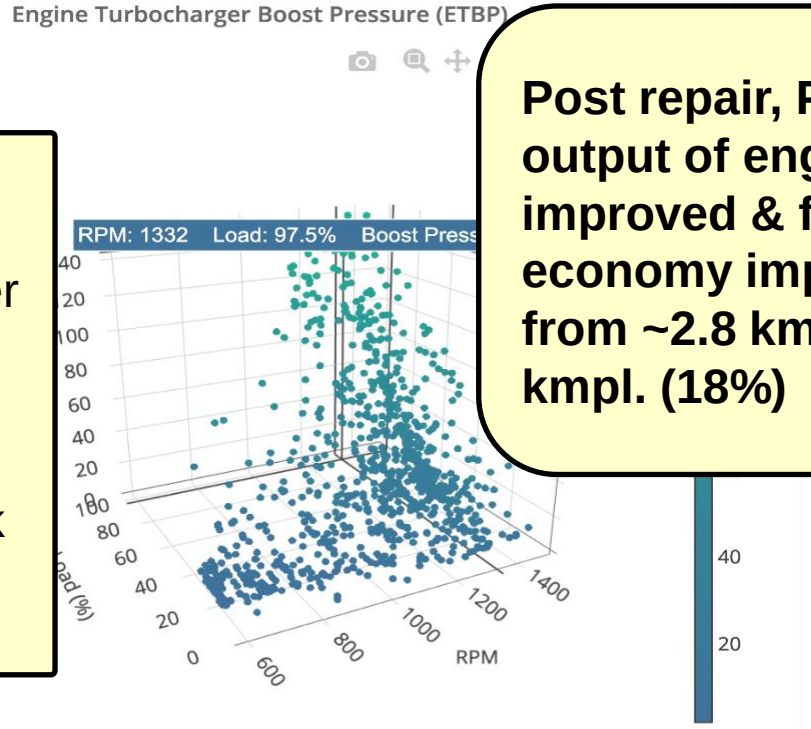
Savings

Fuel: ~ $ 714 pm

Turbo: ~ $ 1430 VGT assembly failure



An under-boost alert was sent to customer – and 5 leakages were discovered in the intercooler when a soap bubble check was performed



Post repair, Power output of engine improved & fuel economy improved from ~2.8 kmpl to 3.3 kmpl. (18%)

Intangles unique turbocharger prediction algorithm provides essential insights about components which could not have been captured otherwise

Strategic partnership with Intel to create a global integrated platform for the mobility sector

INTANGLES
A DIGITAL TWIN COMPANY

✓ This segment involves bilateral engagements with marquee enterprise partners such as Intel, a global ADAS and silicon chips leader

Journey of Intangles with Intel

Intel was looking at integrating reliable FMS gateway with ADAS suite post ME acquisition

Pilot program on 20 intercity coaches in Apr 20 across Private and State-Owned fleet with ME + Intangles FMS

Intel & Intangles is currently codeveloping a 4G ADAS+FMS platform

MOBILEYE + INTANGLES

Go Live in October 2020 but may get delayed due to prevailing conditions

- Intangles showcased its Digital Twin platform to Intel at CVF Conference in Apr 2018
- Explored the possibility of integrating Intangles FMS platform with ME

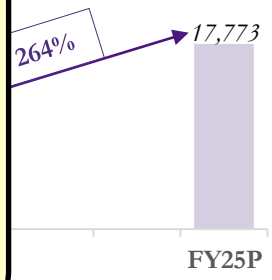
Strategic partnership with Intel to create a solution for

✓ Active/Passive ADAS for Indian Roads,

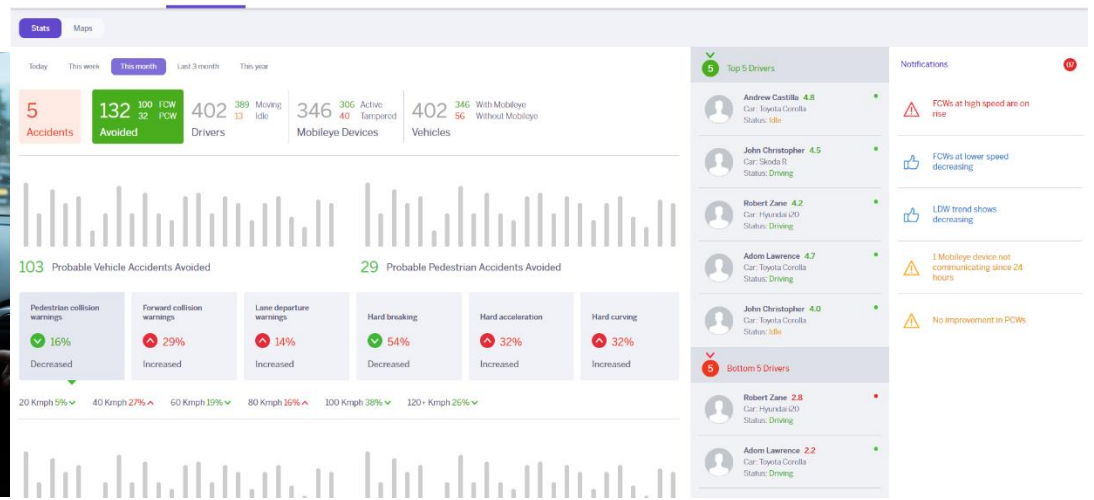
✓ Vehicle Diagnostics

✓ Driver Behaviour Monitoring

✓ Operations Automation and Optimization



Brief look at Dashboard for the platform



Future Scope Launch the Integrated Solution Globally by working with Mobile eye

Foraying into trailer segment with an International player like BPW leading to enhanced penetration in the heavy transport industry

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Intangles devices adopted by OEMs for remote diagnostics, end user application and in use performance tracking

Customized data logger dashboard for OEM

Problem Statement: Interface *With Tractor Electronic Braking System(TEBS) for Remote Diagnostics for* **BPW**

- Successful demo completed with seamless data transmission for vital suspension params such as axle load, braking frequency and pneumatic pressure in brakes/air bellows. Data collection exercise lasted for 4 weeks in harsh trailer ambients.

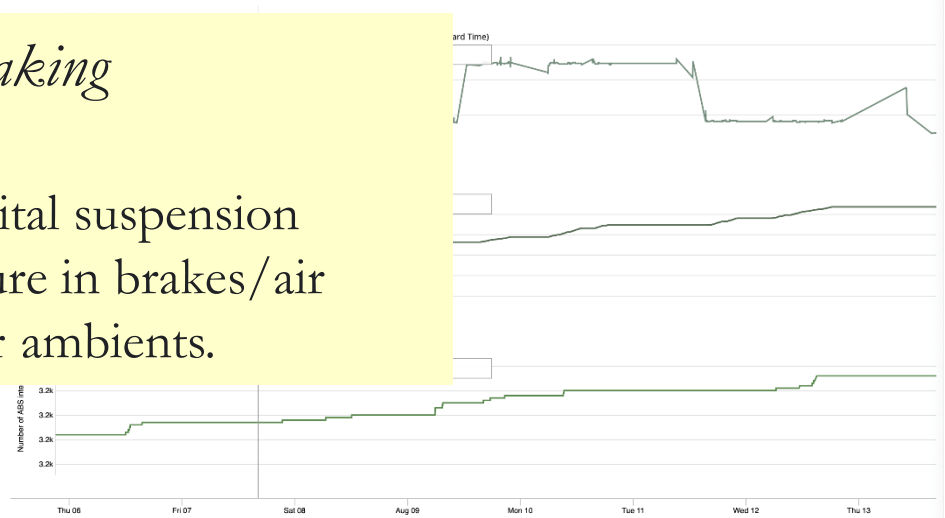
PRESSURE VA

Code			
ebs25_1			
ebs25_2			
ebs25_3			
ebs25_4	Brake cylinder pressure second axle, right wheel	Aug 16, 8:34 PM	0 kPa
ebs25_5	Brake cylinder pressure third axle, left wheel	Aug 16, 8:34 PM	0 kPa
ebs25_6	Brake cylinder pressure third axle, right wheel	Aug 16, 8:34 PM	0 kPa
ebs23_8	Pneumatic supply pressure	Aug 18, 8:35 AM	750 kPa
ebs23_5	Tyre pressure	-	-

Inactive Codes

Code	Description	Severity	MID	Set on

Diagnostic trouble code sampled via Uniform Diagnostic Service



LIVE | DATA LOGGER | ERROR CODES | LOCATION

Switches showing the status of control systems

PARAMETERS

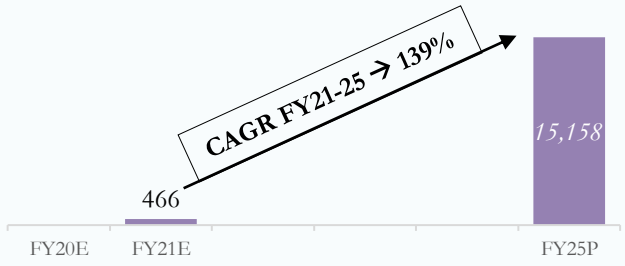
Code	Description	Time	Value
axl	Current axle load	Aug 16, 8:36 PM	17100 kg
917	Total Vehicle Distance	Aug 18, 8:36 AM	505925.8 km
trips	Number of trips	Aug 16, 8:36 PM	88
nbasl	Brake actuations with stop light supply	Aug 16, 8:34 PM	234
nba	Number of Brake applications	Aug 16, 8:34 PM	290009
absi	Number of ABS interventions	Aug 16, 8:35 PM	3201
rss1	Number of RSS stage 1 interventions	Aug 16, 8:35 PM	15
rss2	Number of RSS stage 2 interventions	Aug 16, 8:35 PM	1
braking_frequency	Braking frequency (Brake Applications per 100km)	Aug 16, 8:34 PM	57

SWITCHES

Code	Description	Time	Value
ebs23_1_7	Vehicle pneumatic supply pressure	Aug 18, 8:35 AM	Sufficient
ebs22_1_1	Vehicle ABS	Aug 16, 8:35 PM	Active
ebs22_1_3	Vehicle retarder control	Aug 16, 8:35 PM	Active
ebs22_1_5	Vehicle service brake	Aug 16, 8:35 PM	Active
ebs22_1_7	Automatic towed vehicle braking	Aug 16, 8:35 PM	Active
ebs22_2_1	Vehicle electrical supply	Aug 16, 8:35 PM	Sufficient
ebs22_2_3	Red warning signal	Aug 16, 8:35 PM	Active
ebs22_2_5	Amber warning signal	Aug 16, 8:35 PM	Active
ebs22_2_7	Electrical supply of non-braking systems	Aug 16, 8:35 PM	Active
ebs22_4_5	Stop lamps request	Aug 16, 8:35 PM	Active
ebs23_1_1	Tyre Pressure Switch	Aug 18, 8:35 AM	N/A

Road Ahead

Cumulative No. of Trailers



Sales from additional trailers produced → 100% penetration

5,000 – 6,000

Increasing penetration in the retro fitment market from FY23

Future Scope with Trailer Industry

Enterprise Partnership with Maruti Suzuki for real time emission monitoring

Problem → Currently engaged with one of the largest PV OEM for In Use Performance Ratio (IUPR)

Journey of Intangles with the OEM

OEM e… Intangles from Digital Twin solutions to aid … a…

OEM and Intangles to leverage real time diagnostics/connectivity to comply with highly constricted limits for NOx, CO, and hydrocarbon emissions

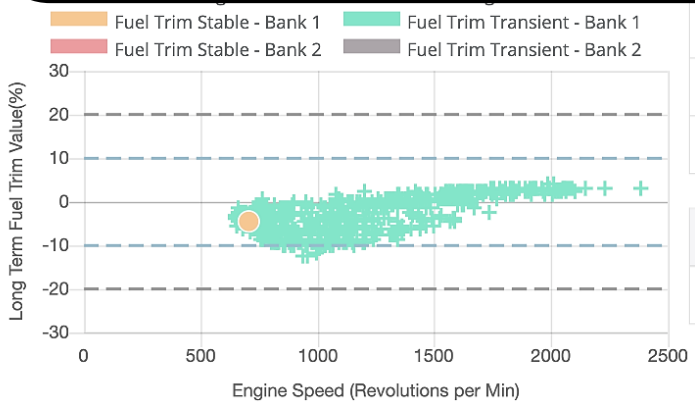
in NCR region

OEM and Intangles strategize to redefine on board diagnostic monitors

Insights into the strategic partnership and Future Potential

Objective:

Emissions compliance and higher fuel efficiency



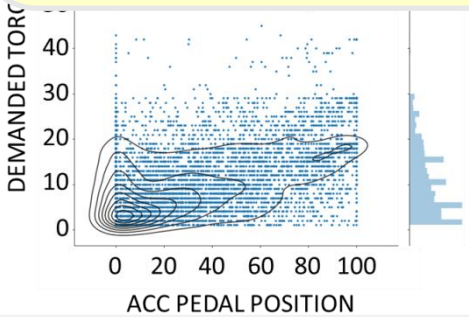
Fuel trim @ stable engine speed	-4.6875	-	[-10,10]
Standard deviation in trim values @ stable engine speed	0	-	-
Fuel Trim @ transient engine speeds	-7.8125	-	[-20,20]

Alert Message	Date	Prognosis	Details
Combustion ratio is within limits	Feb 3rd, 6:26 pm	Good	Details

Future Scope — **Platform as a service for the entire range of OEM vehicles**

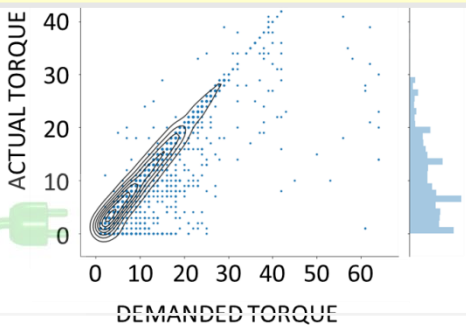
Electrical vehicle

1. Precise projections for distance to empty on intracity electric buses. Measure on instrument cluster found to be unreliable.
2. Profiling of ideal driving and charge session characteristics to optimize battery pack

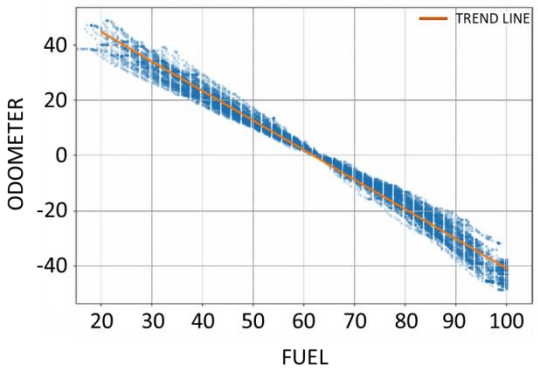


drive mode even at halts/stoppages. Motor Torque generated compensated by brake depression .

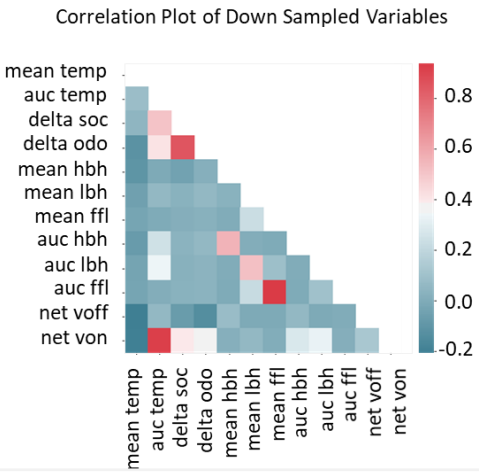
- Drivers encouraged to use 'N" or "P" modes at halt to reduce aggregate demanded, hence actual motor torque.



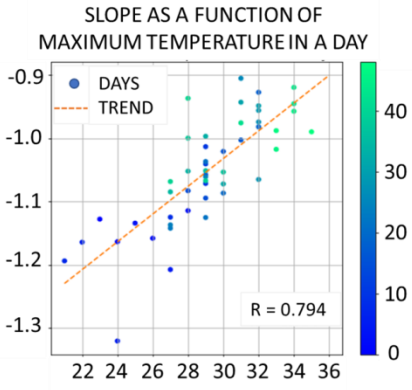
Transmission slippages tracked as offset between actual-motor and demanded torque in most normal contours.

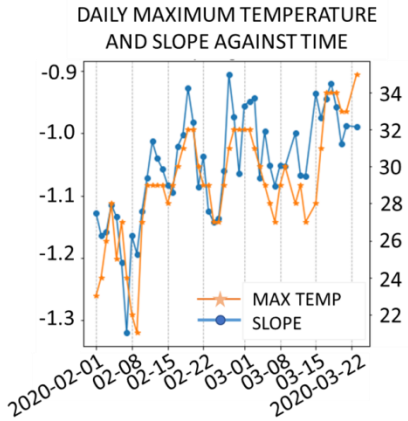


- DTE: Vehicles on the same route exhibiting high level of variance in daily full charge to empty ranges. Digital Information System estimates for distance to empty found to be highly unreliable. Ad hoc charging session based on spurious DTE readings leading to route-schedule disruption.



- Proprietary data model for predicting distance to empty which continuously learns from a plethora of dynamics like ambient weather conditions, battery pack cooling efficiency, usage trends for on board lighting, above and over historic trends for SOC as a function of estimated average speed.





- Among several predictors used by Intangles proprietary data model, ambient weather, specifically temperature is found to have a very strong correlation with battery discharge trends. The algorithm collates temperature from multiple sources including on board ambient temperature sensors, on-line sources based on geo coordinates to deliver highly accurate distance to empty projections.

As professionals from the field of quality management we have a choice?

either

Develop new capabilities and remain relevant

or

Play a diminishing role

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QUALITY FOR HUMANITY

Thank You

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