Selection of Right Tools and Technologies

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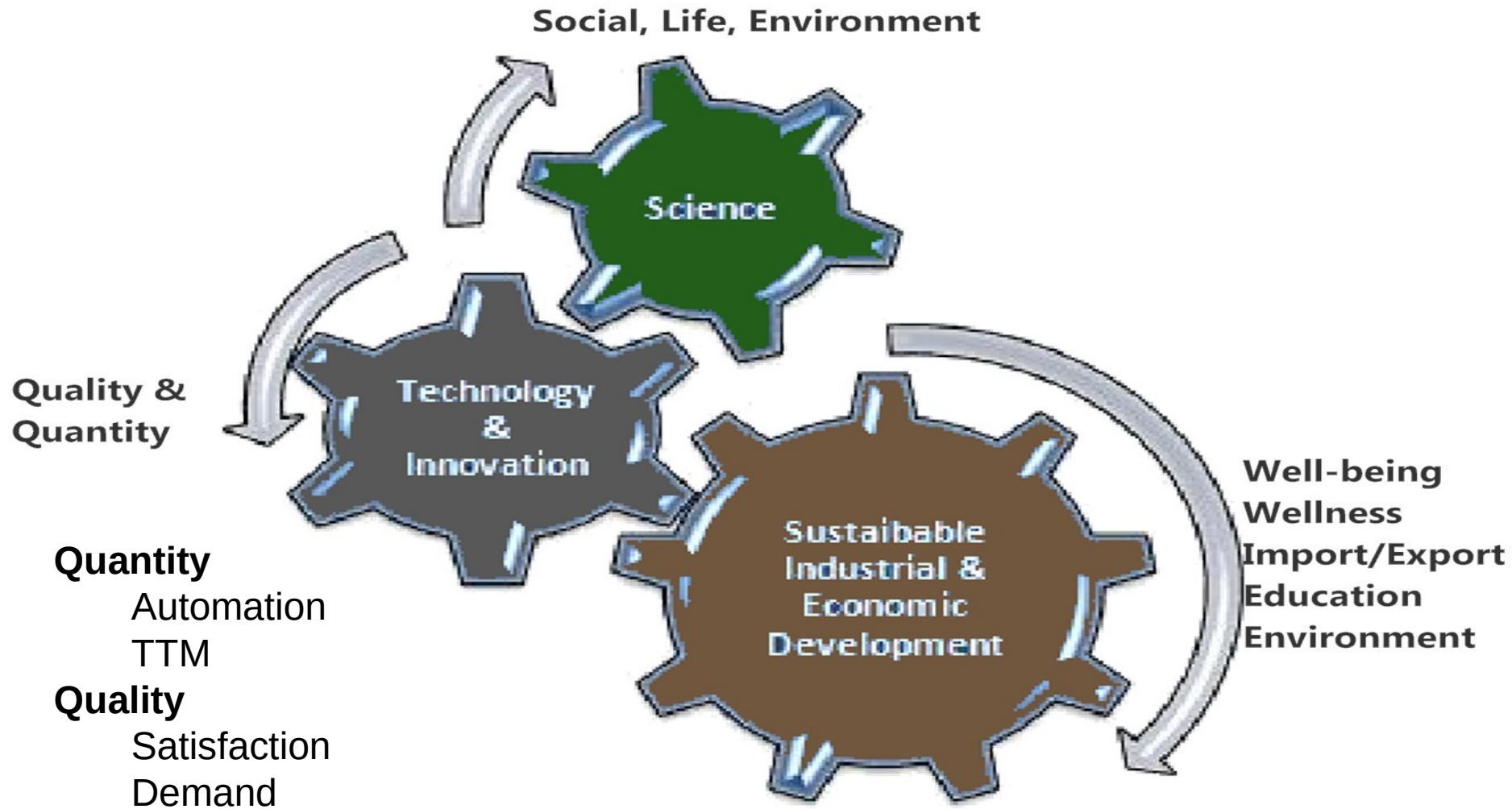
Previous Session

- **Identify Challenge Having Impact for Research**
- **Integrate Technological Solution (Emerging Tech)**
- **Apply Bottom-Up Approach for Solution**

Agenda

- Identify Impact based Research
  - Identify Challenge Having Impact for Research
  - Integrate Technological Solution (Emerging Tech)
  - Apply Bottom-Up Approach for Solution
- **Selection of Tools and Technologies**
- Success Stories

Sustainable Industrial and Economic Development

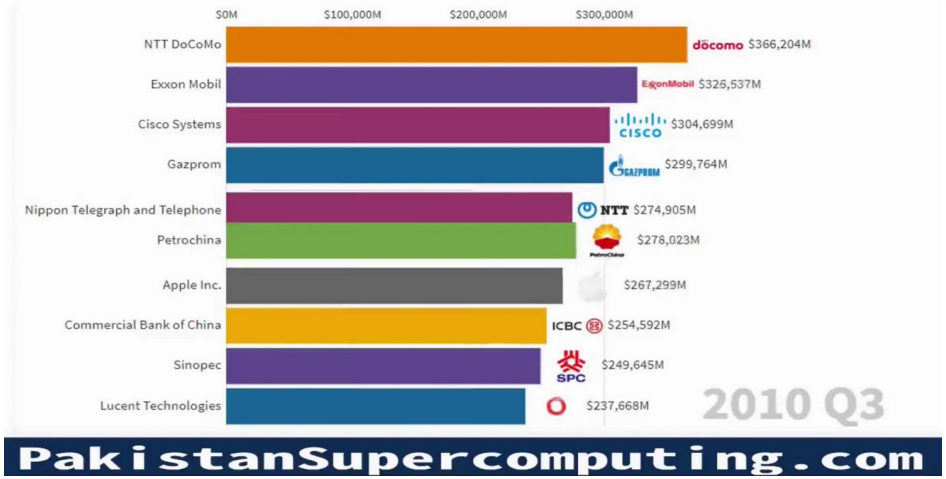


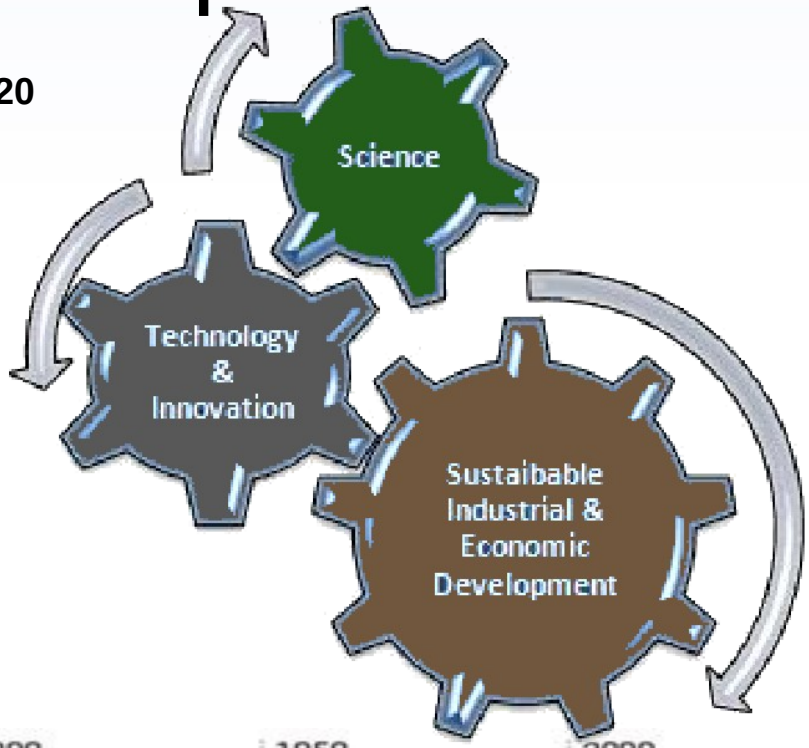
Quantity
- Automation
- TTM

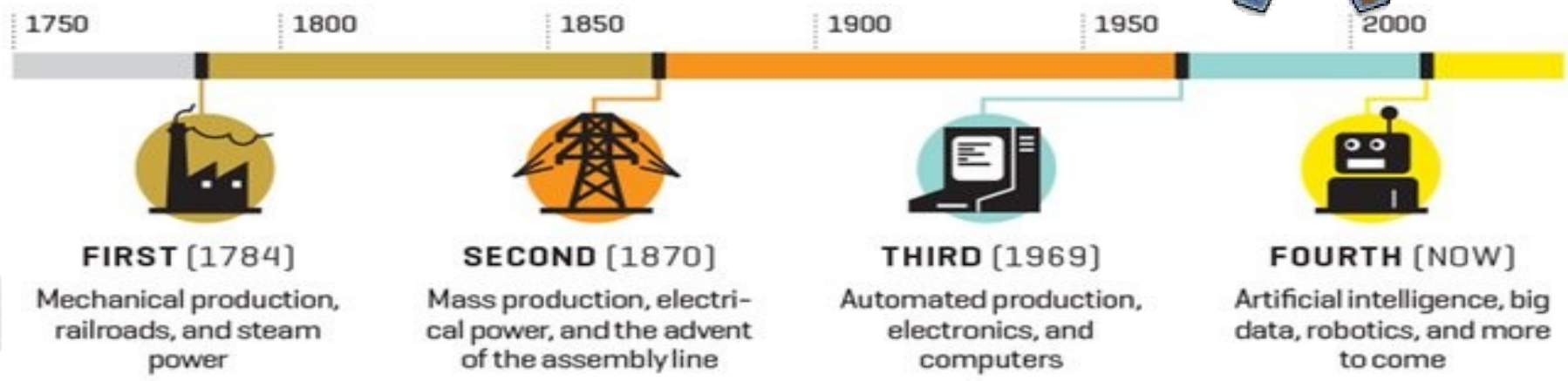
Quality
- Satisfaction
- Demand

Industrial Revolutions and Sustainable Developments

Top 10 Biggest Companies By Market Size From 2010 - 2020

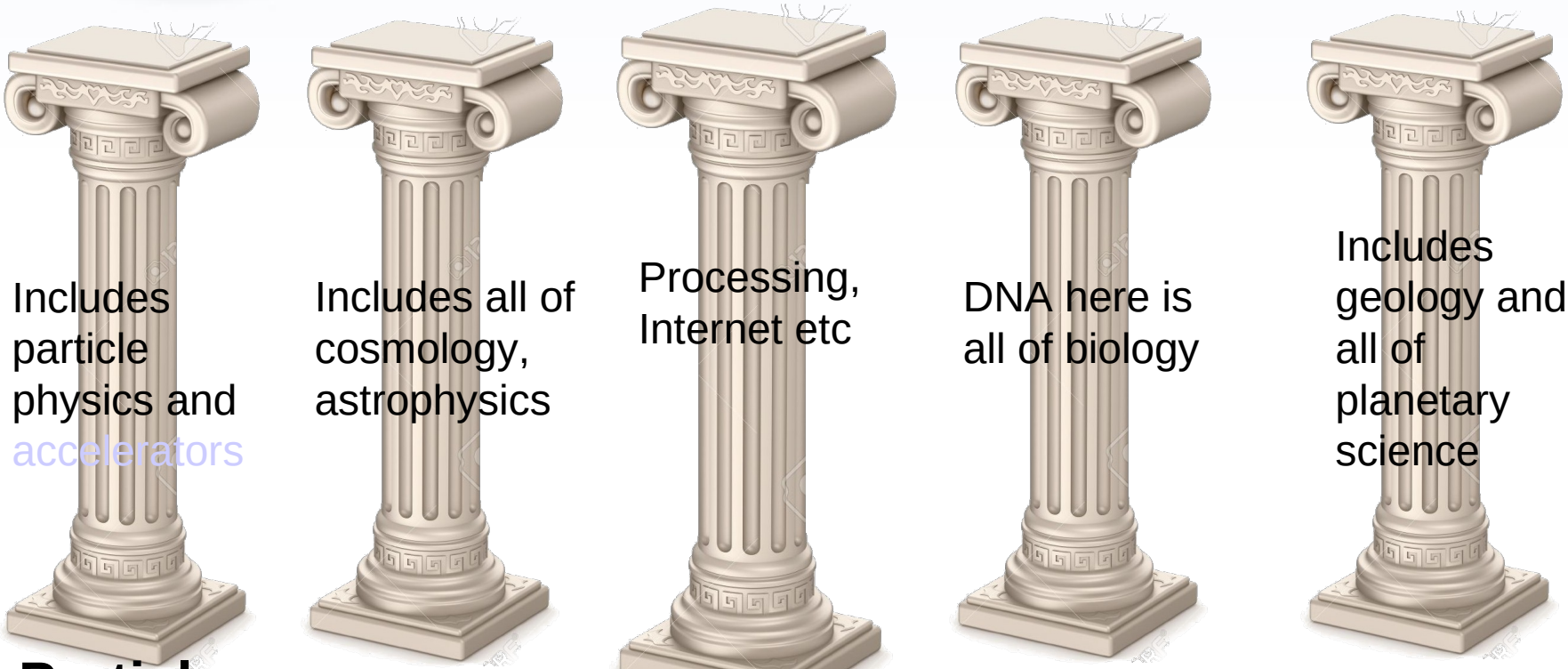






Computing Technology

Fermi National Accelerator Laboratory



"Machine intelligence is the last invention that humanity will ever need to make"

Nick Bostrom
Philosopher, University of Oxford

17 goals on the United Nations' 2030 Agenda for Sustainable Development:

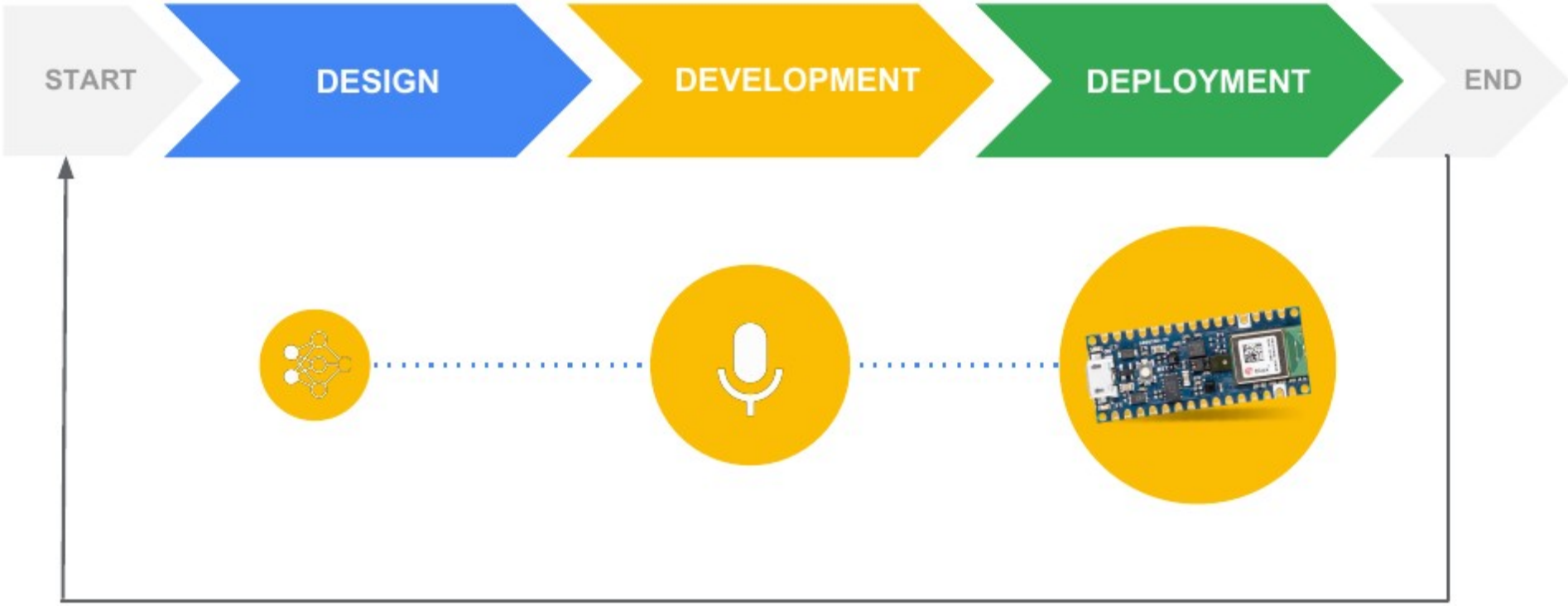
- Ending poverty and world hunger
- Improving health and education
- Reducing inequality and injustice
- Clean water and sanitation
- … etc.

Tech Issues

Microsoft ChatBot (Twitter – Offensive Content)

Amazon Secret AI Recruiting Tool (Biased Against Women)

Google Calls (2019) Hidden Microphone in its Nest Home Security Devices an ‘Error”


START
DESIGN
DEVELOPMENT
DEPLOYMENT
END

Life Science

Earth Science

Social Science

Science

175 ZByte @2025

80%
Data-Sciences

Data

100 ExaFLOPS
@2020

87.04 B$

234.6 B$ @2025

AI

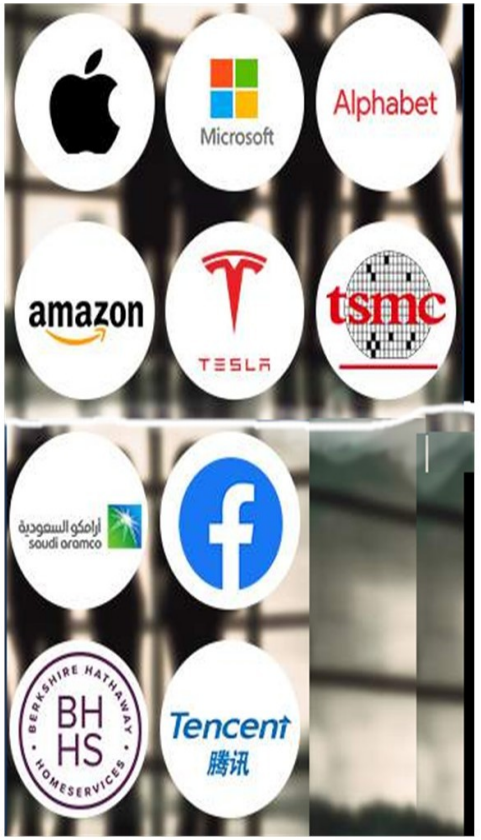
Top500 List
8 PetaFLOPS
@2022

uProcessor
100 B$ @2020

30% Cell Phone
20% Embedded
App
50 Servers, PCs etc.

Computing

Digital Industrial Age
5.5 Trillion $ Revenue@2021



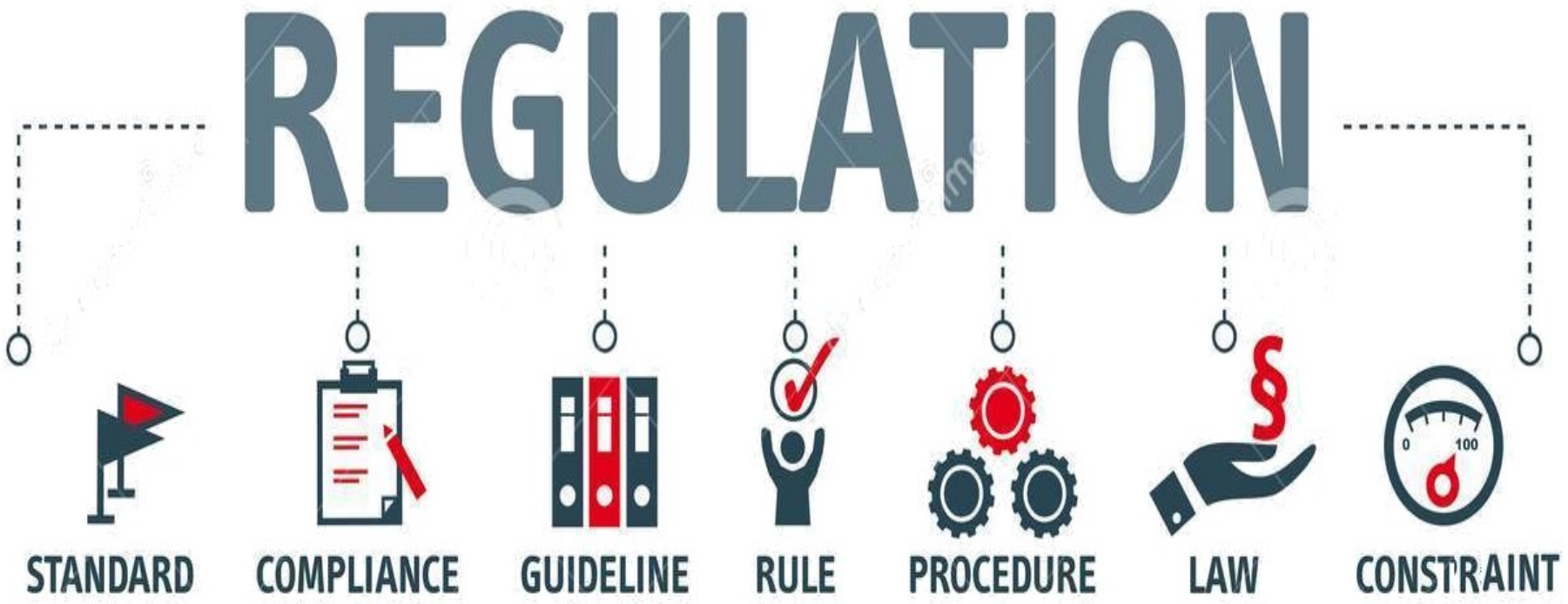
Tools and Technologies for Sustainable Research and Development

- Standards, Compliance and Regulation
- Data Architecture
- Software Architecture
- Hardware Architecture
- User Interactive Interface

Grading

- Domestic
- Industrial
- Medical
- Military
  - Design Characteristics
  - Sophisticated Wear Leveling, Defect Management and Error Checking & Correction (ECC)
  - Write Endurance
  - Supported Temperature Ranges
  - Product Life Cycles
  - Unexpected Power Interrupt Handling

Compliance and Regulation



Regulation Bodies

Communication Commission

Information Commission (Data)

Health Regulator Authority

Compliance

User types, location, counts, and security

Purchase agreements and licensing terms

Product use rights, license types and entitlement

Virtualization strategy

Hosted, cloud or shared environment

New technology adoption

Software deployment versions, location, and counts

Server and workstation hardware inventory

Product usage and deployment strategy

Data Architecture

- Standardized (Structure)
- Easy Handling
- Flexible for new entries
- Adoptable
- Portable

Software Architecture

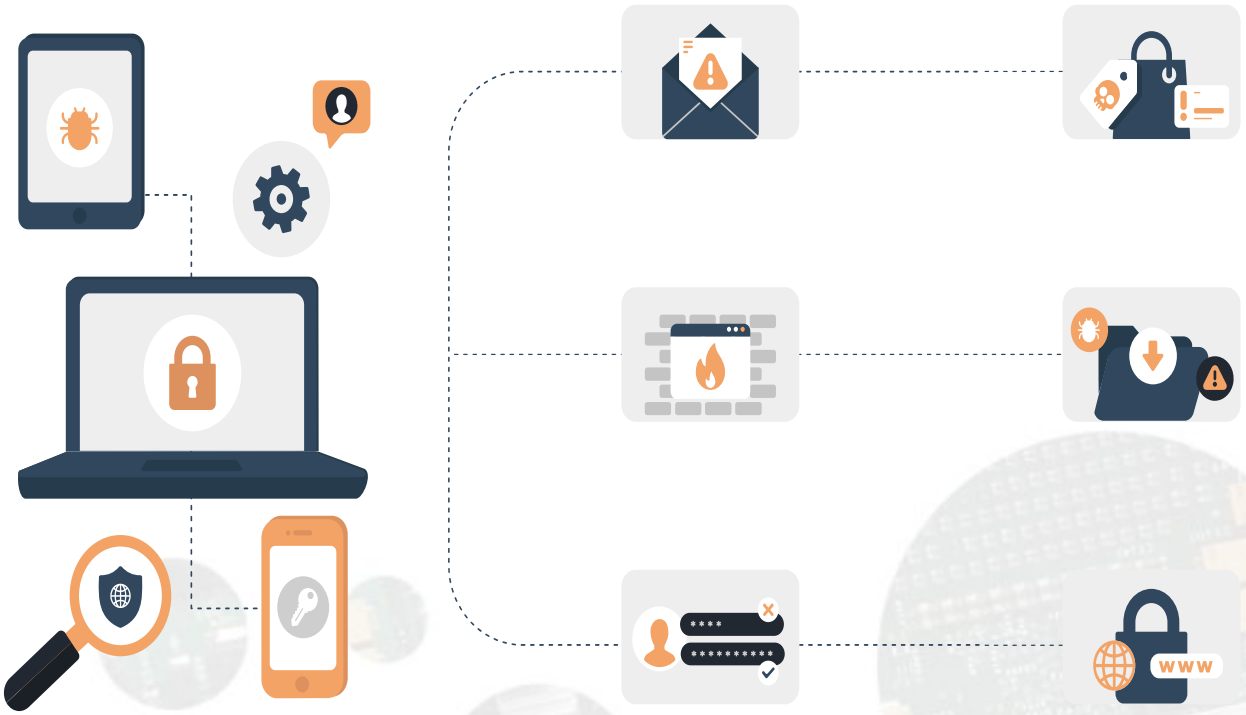
- Tool Chain
- Algorithm Control Data Flow
- Accuracy
- Performance Scalable
- Portable

Hardware Architecture

- Targeted Technology
  - Required Performance
  - Embedded, Bare-Metal, Cloud
- Programmability
- Fault Tolerance

User Interactive Interface

- Usability
- Accessible
- Infographic



Agenda

- Identify Impact based Research
- Selection of Tools and Technologies
- **Success Stories**

Int'l Projects

- Design Ultra Low Cost Display Camera Interface for Mobile Baseband XGold Chip
  (Infineon Techonogies, 200 million single chip)

- Implementation of Reverse Time Migration on FPGAs
  (BSC-REPSOL, PLDA Italia, Cambridge Science Park)

- Open source European full-stack ecosystem based on a new RISC-V CPU
  (Barcelona Supercomputing Center)

National

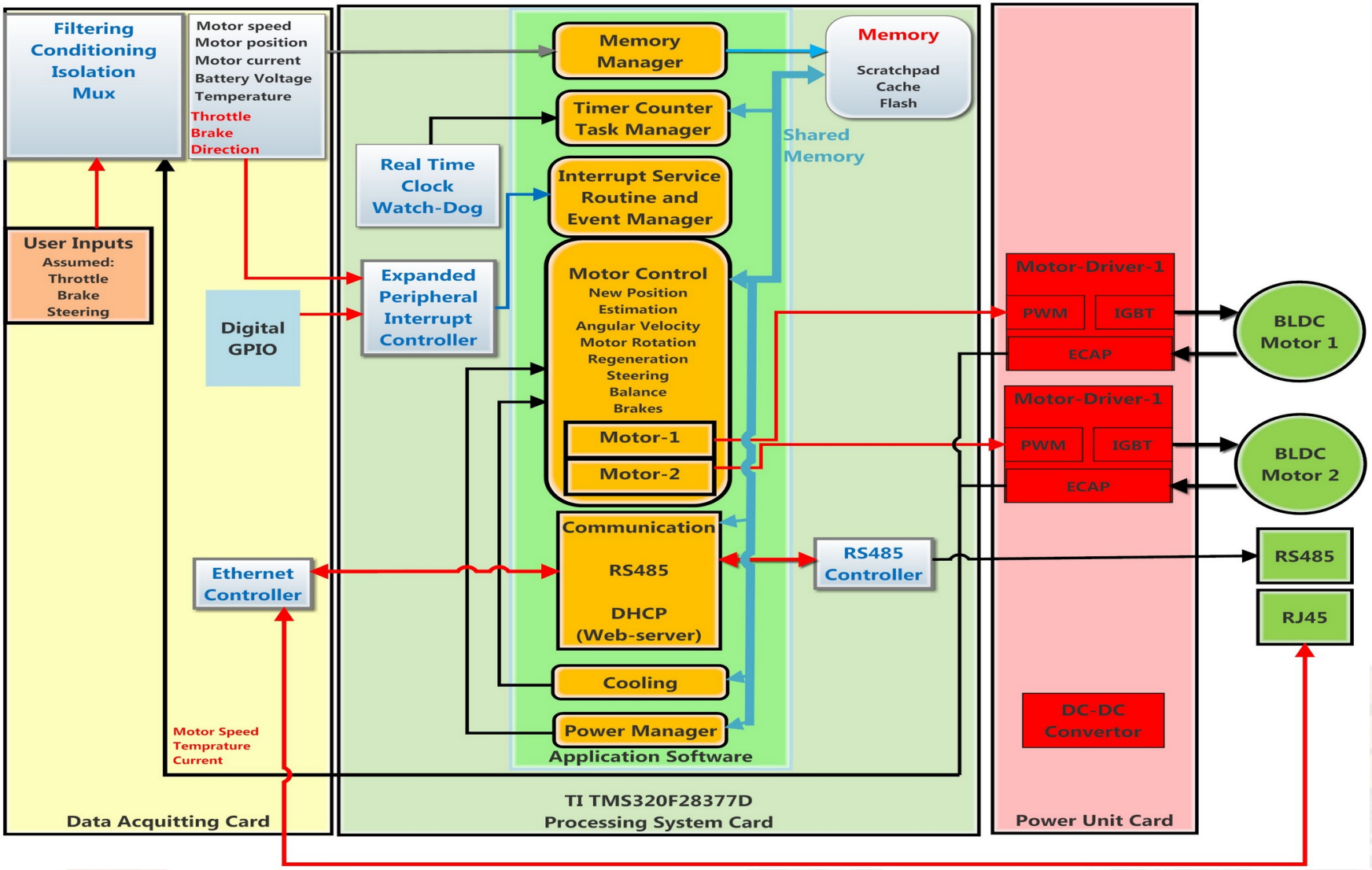
- Smart Motor Controller
- FootAnalytic
- Rice Sorting Machine
- Low Power and Low Cost Supercomputing System

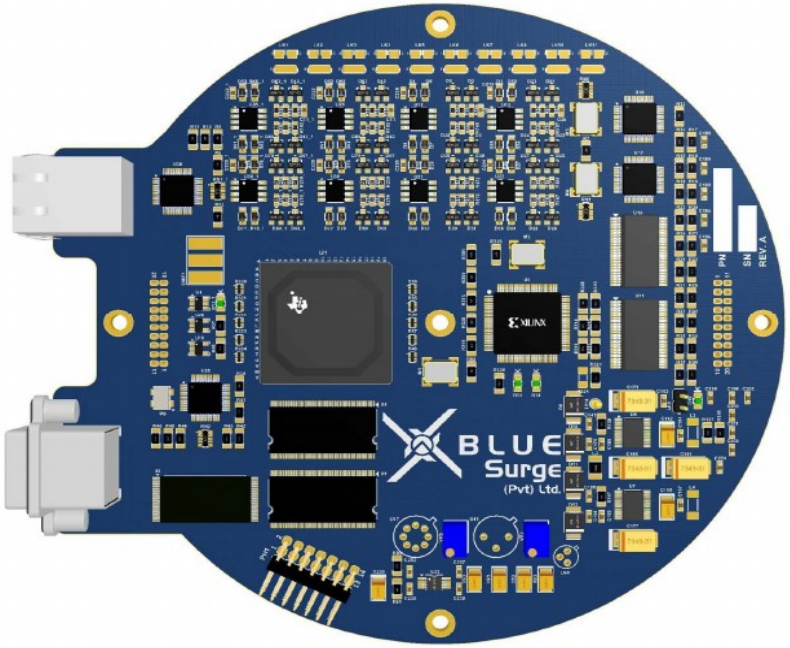
Smart Motor Controller

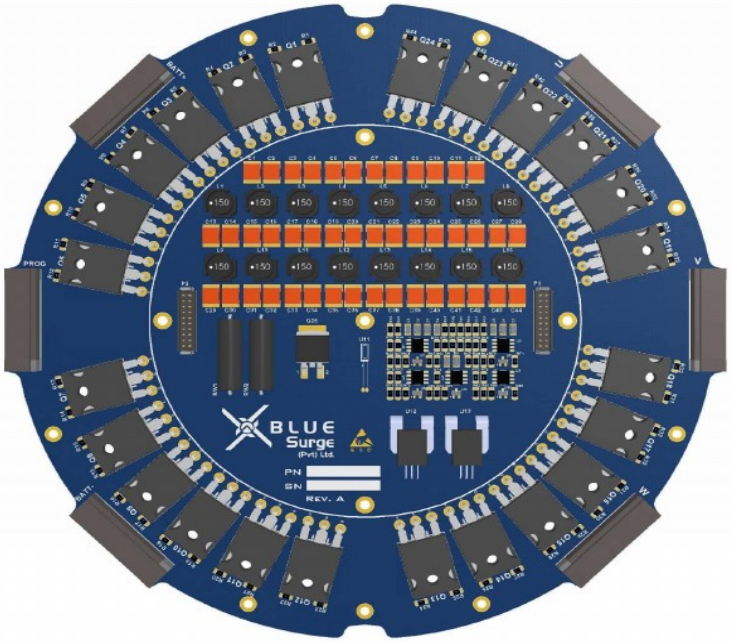
Proposed BLDC	Power Factor	Manufacturing	Revenue (Billion PKR)	Energy Reduction Mega Watt Hour
Improves	85-90%	4 Million = With 50% of Production	20 = With 40% Increase	720 = With 30% Power Saving

Working Investment	15000000
Capital Investment	10000000
Average Product Price	1477.265625
Average Sale Price	1934.816
Average Gross Profit/Year	19.42987936
Total Gross Profit (5 Years)	97.1493968
ROI	**4%**
IRR	**54%**
NPV	**10,028,468**
Pay Back Period	**3.16**

Smart Motor Controller




BLUE
Surge
(Pvt) Ltd.
PN
SN
REV. A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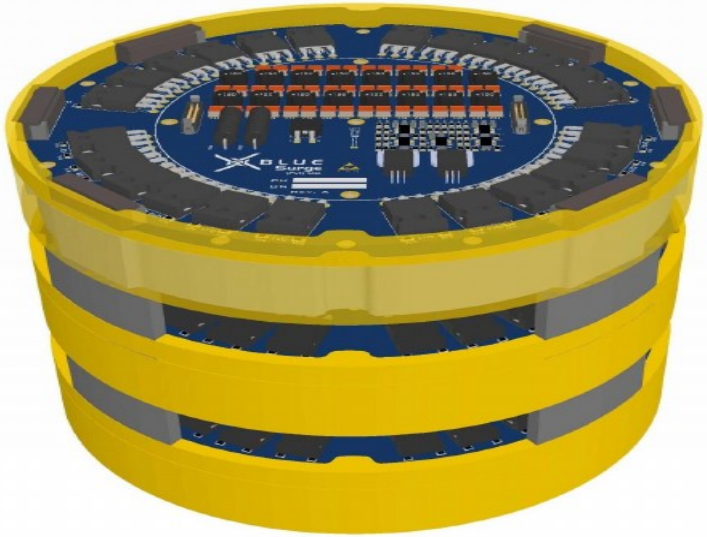
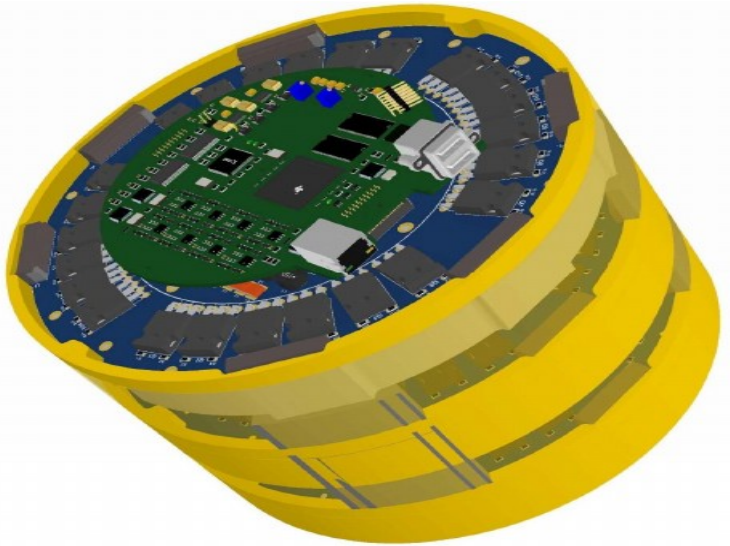
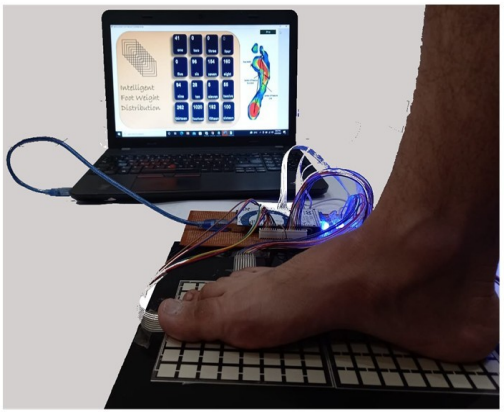
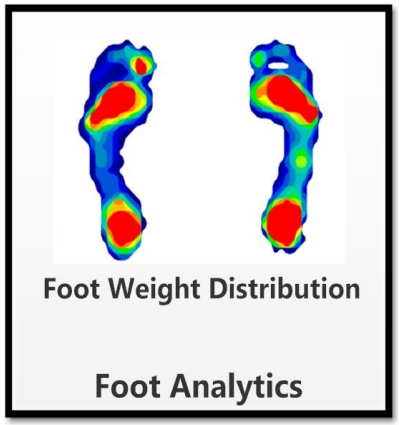
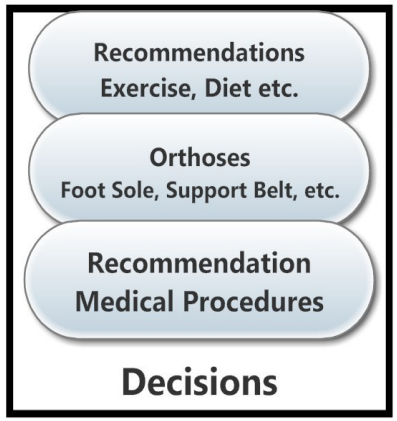




Foot Analytic



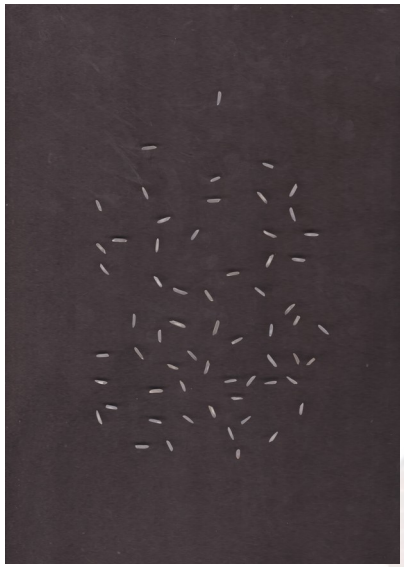


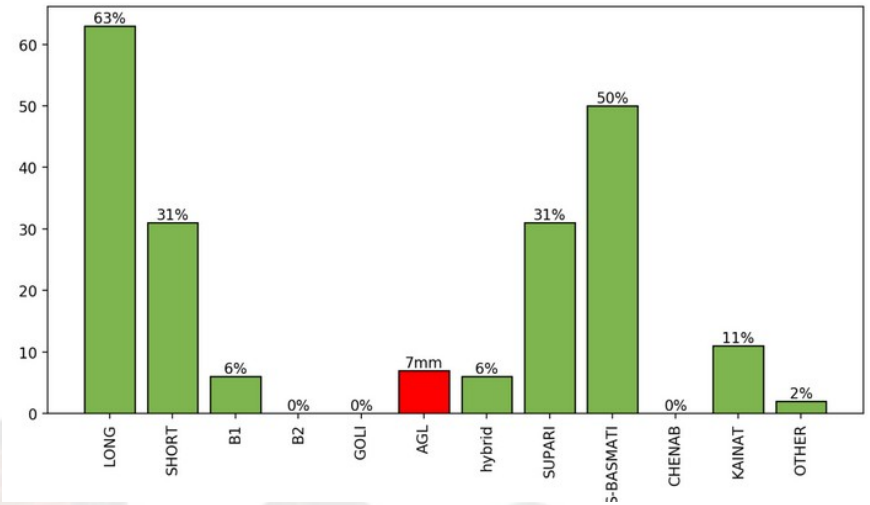


Years	1	2	3	4	5
No of Unit Produced	20	100	150	200	250
Unit Product Price	30,000	35,000	40,000	50,000	60,000
Unit Sale Price	50,000	60,000	75,000	80,000	100,000
Services (Renting)	500,000	1,000,000	1,500,000	2,000,000	2,500,000
Cost of Production	600,000	3,500,000	6,000,000	10,000,000	15,000,000
Revenue	1,500,000	7,000,000	12,750,000	18,000,000	27,500,000
Operational Cost	500,000	500,000	1,000,000	1,200,000	1,500,000
Administrative Cost	200,000	200,000	300,000	300,000	300,000
Misc. Other Cost	250,000	300,000	350,000	400,000	500,000
Total Cost	950,000	1,000,000	1,650,000	1,900,000	2,300,000
Net Profit Before Tax	-50,000	2,500,000	5,100,000	6,100,000	10,200,000
Gross Profit	-60,500	1,975,000	4,029,000	4,819,000	8,058,000

Rice Color Sorting Machine

Color Sorting Machine	Price / Unit US Dollars	Market (Unit Demand)	Revenue US Dollars
Imported	50,000	100	5,000,000
Proposed	25,000	200	5,000,000

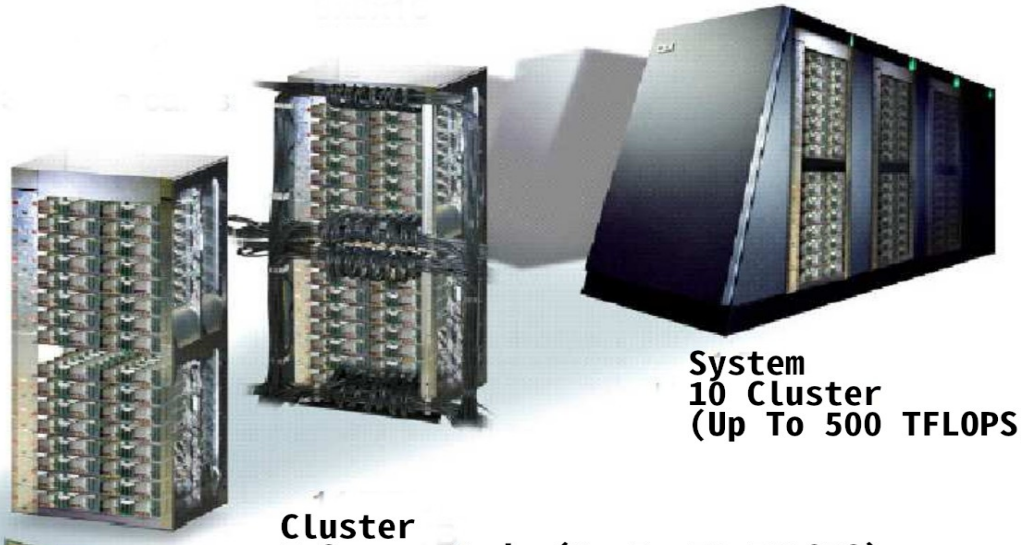




	CATEGORY	VALUE
0	Total Grain	62.0000
1	%_Long Grain	92.0000
2	%_Broken Grain	8.0000
3	AGL	7.0000
4	%_Goli	0.0000
5	%_B2	0.0000
6	%_B1	6.0000
7	%_Short	31.0000
8	%_Long	63.0000
9	%_Chalky	12.0000
10	%_Whiteness	11.7906
11	%_Hybrid	6.0000
12	%_Supri	31.0000
13	%_S-Basmati	50.0000
14	%_Chenab	0.0000
15	%_Kainat	11.0000
16	%_Other	2.0000

Supercomputing System

PAKISTAN™ SUPERCOMPUTING



System
10 Cluster
(Up To 500 TFLOPS)

Cluster
5 Server Node (Up To 76 TFLOPS)
Infini Band

Server Node (upto 20 TFLOPS):
48 cores
96 GB RAM
1 TB Disk
2 GPUs

CentOS Linux

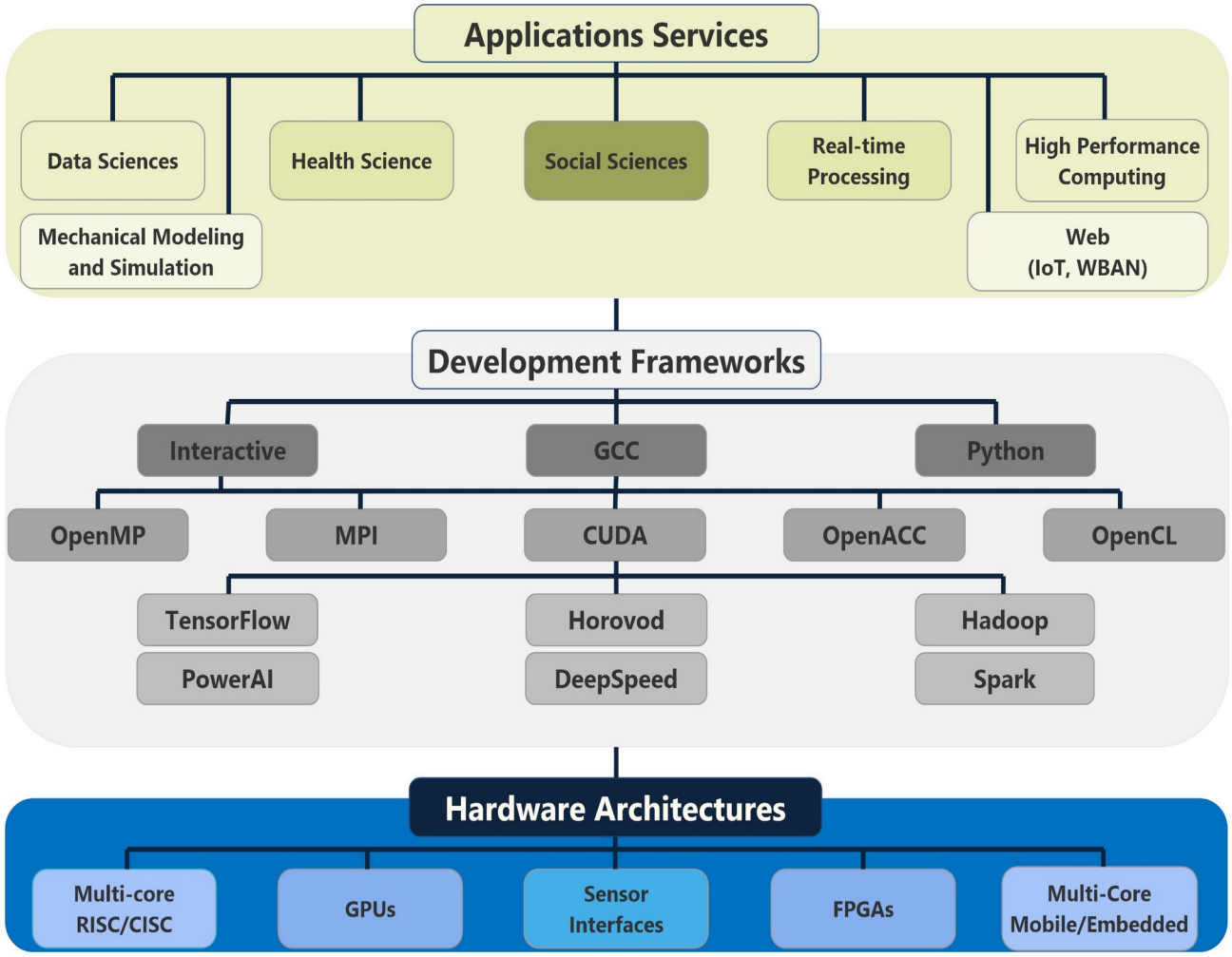
Chip

4 cores

XEON Processor

Barcelona Supercomputing Center
Centro Nacional de Supercomputación

- Applications:
  - Data Sciences
  - Artificial Intelligence
  - HPC
  - Simulation & Modeling
- Targeted Hardware:
  - Cloud-Computing
  - Super-Computing
  - Embedded-Computing
- Salient Features:
  - Time-Critical
  - Accurate
  - High Performance
  - Virtual & Bare-metal



Thanks:
How To Do Commercializable Research

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Intelligent Algorithms

- Senors Inputs (x) = Algorithm = Decisions Outputs (y)
- Data (x) = Program = Outputs (y)
- (Labeled) Outputs (y) = F (x) (computation) => **Program**
- F (x) = Training Models
  - Accuracy
  - Performance

Synergy: Science and Technologies

EXCELENCIA SEVERO OCHOA

erc European Research Council

Funding Sources

Partners

Computer Sciences

To influence the way machines are built, programmed and used: programming models, performance tools, Big Data, computer architecture, energy efficiency

Earth Sciences

To develop and implement global and regional state-of-the-art models for short-term air quality forecast and long-term climate applications

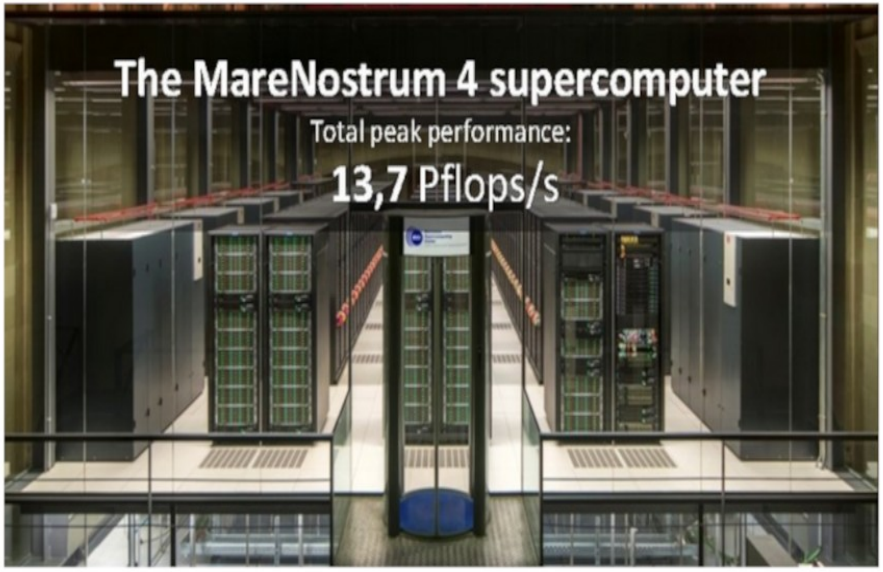
Life Sciences

To understand living organisms by means of theoretical and computational methods (molecular modeling, genomics, proteomics)

CASE

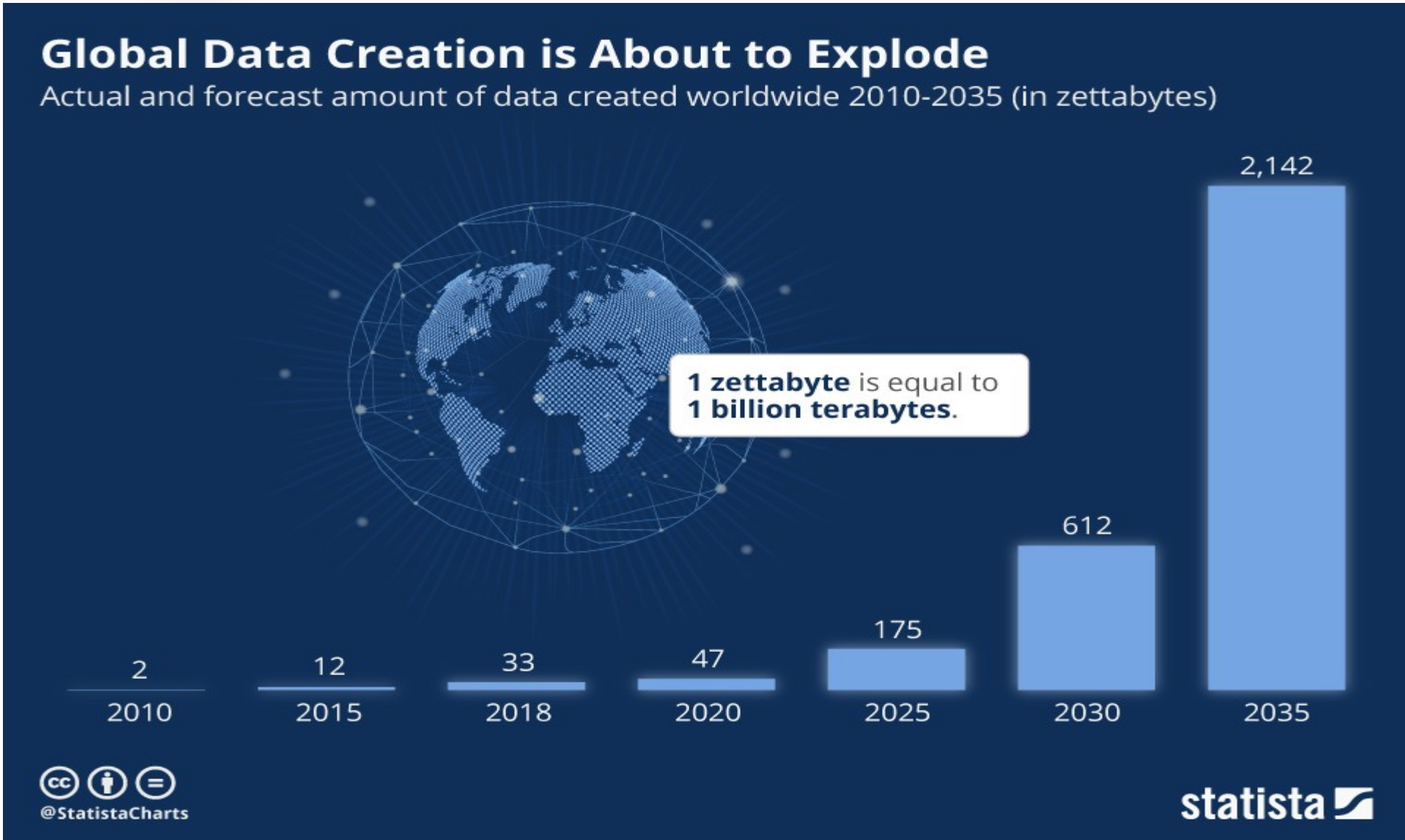
To develop scientific and engineering software to efficiently exploit super-computing capabilities (biomedical, geophysics, atmospheric, energy, social and economic simulations)

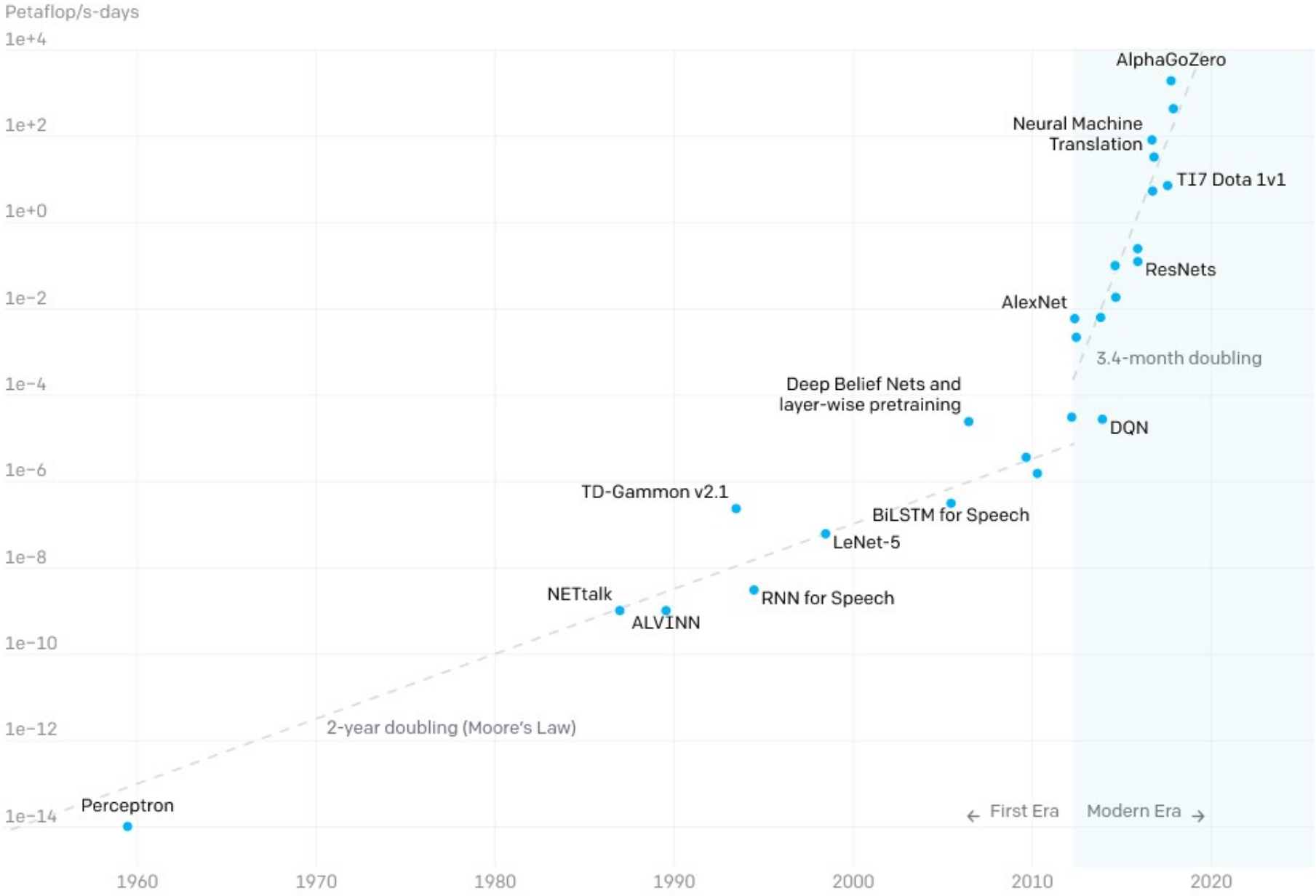
Departments



Computing Resources

Data Forecast

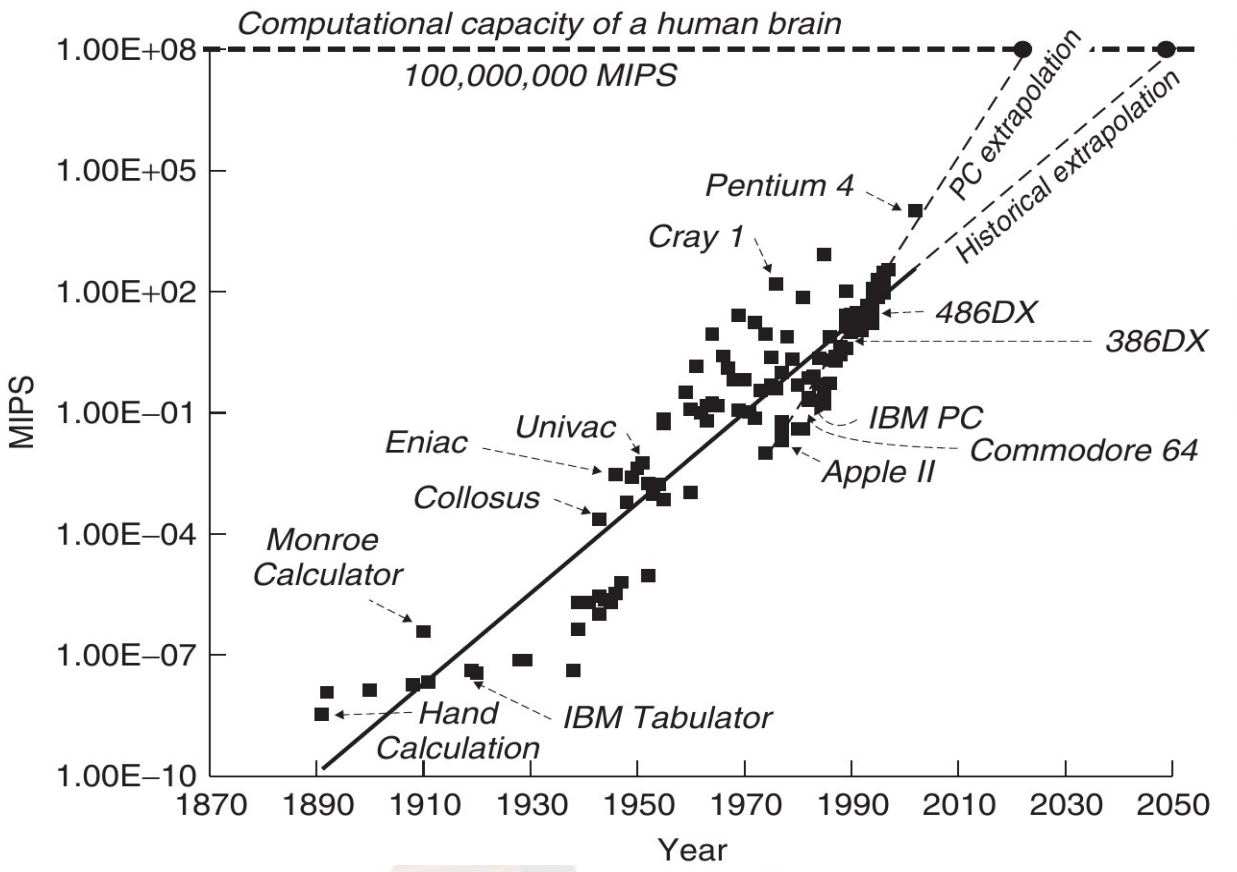


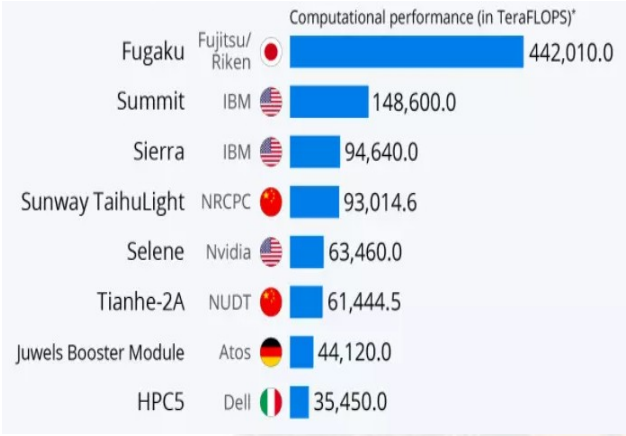


Total amount of calculations, in Petaflop per day, that have been used to train neural networks that have their own name and are referents in the Deep Learning community

WWW.Tassadaq.PakistanSupercomputing.COM

Computational Capability ?





It is estimated that sometime between the years **2025 and 2050**, a **personal computers** will exceed the calculation power of a human brain.