Analytics@TP

Presented by: *Michael Yap*

Agenda

Our Analytics Journey

Capability Development

Challenges

Sample of Data Products

    Student Analytics

    Learning Analytics
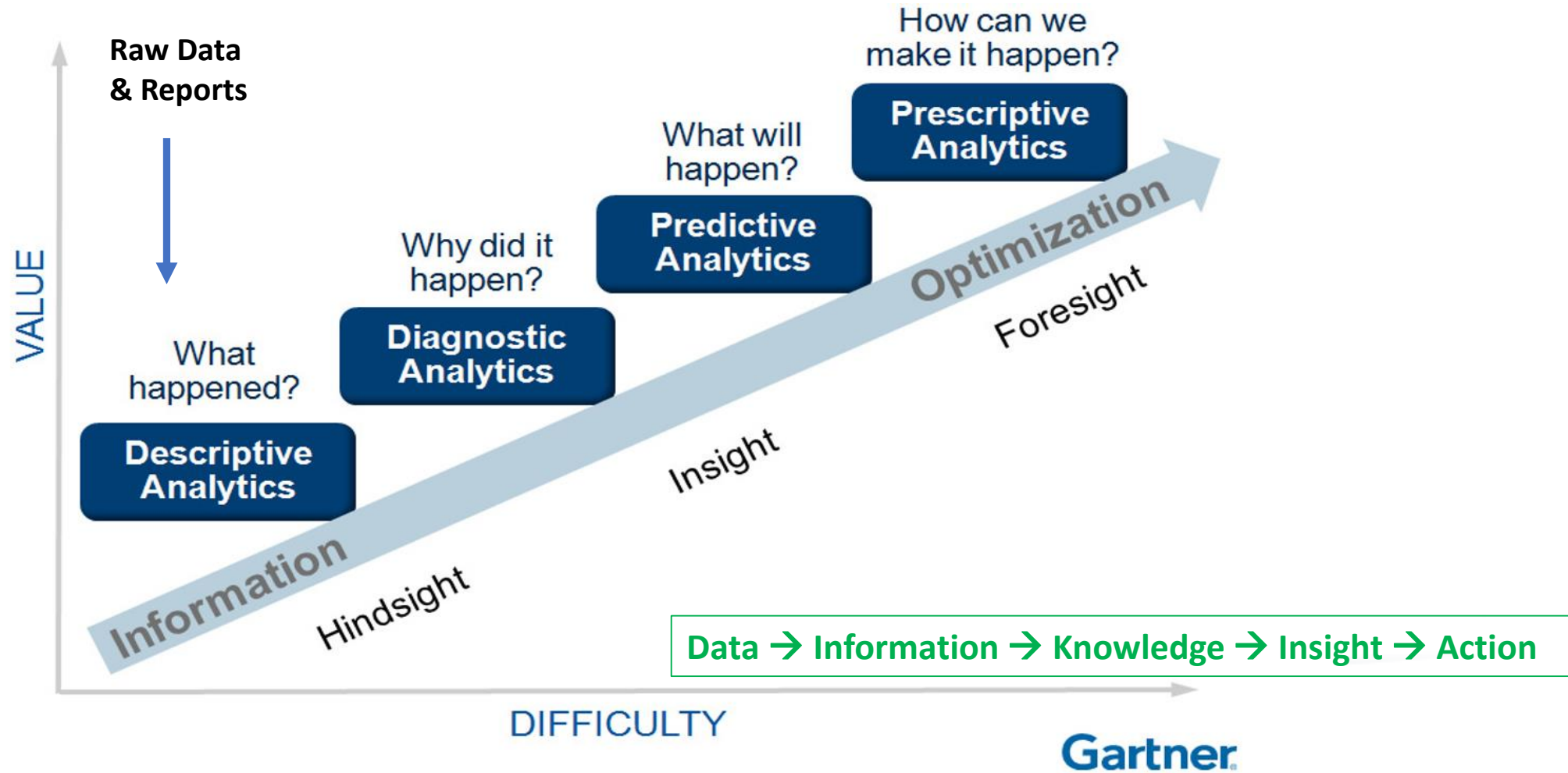
    Graduate Analytics

    Procurement Analytics
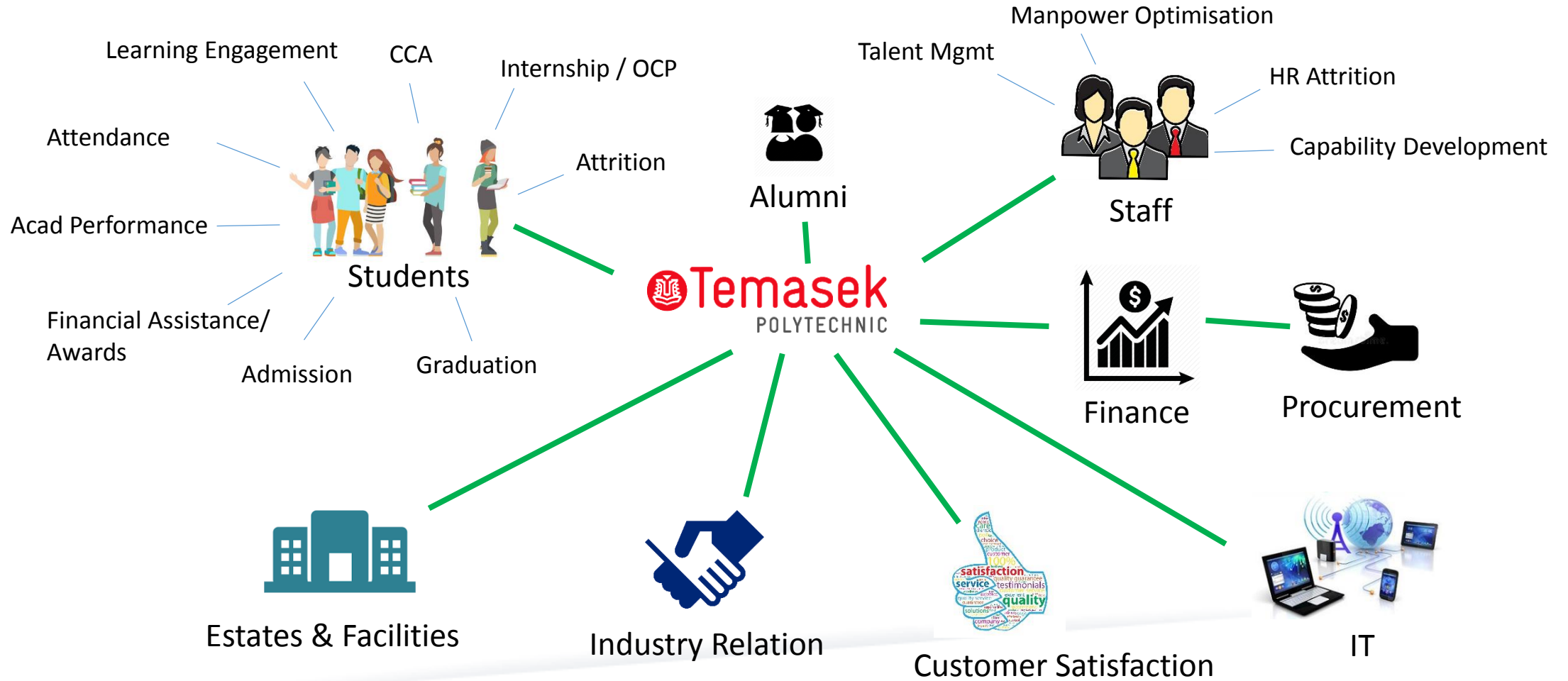
Text Analytics

IoT Analytics

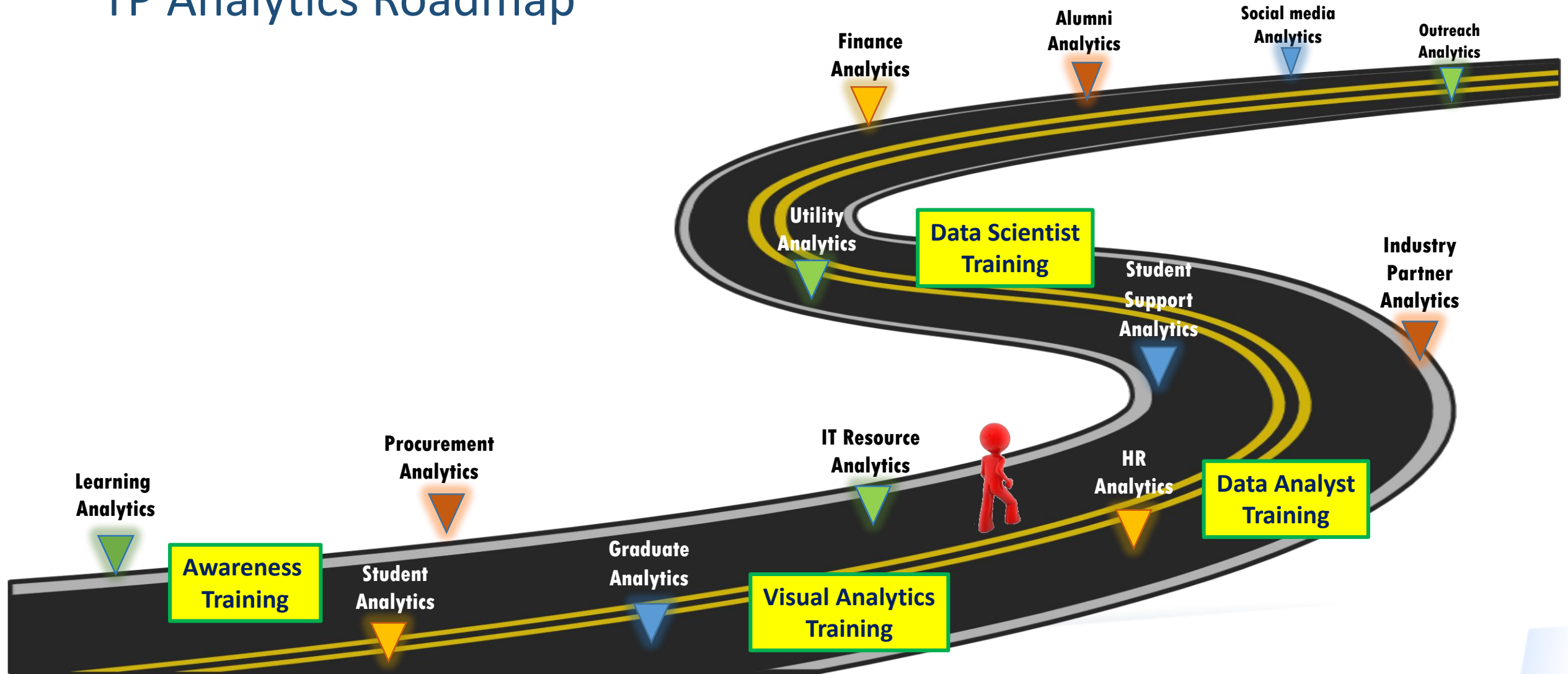**Summary**

Our Analytics Journey

Gartner Analytics Ascendancy Model

Data → Information → Knowledge → Insight → Action

What can we analyse ?

Students
- Learning Engagement
- CCA
- Internship / OCP
- Attendance
- Attrition
- Acad Performance
- Financial Assistance/ Awards
- Admission
- Graduation

Alumni

Staff
- Talent Mgmt
- Manpower Optimisation
- HR Attrition
- Capability Development

Finance

Procurement

Estates & Facilities

Industry Relation

Customer Satisfaction

IT

TP Analytics Roadmap

Finance Analytics

Alumni Analytics

Social media Analytics

Outreach Analytics

Utility Analytics

Data Scientist Training

Student Support Analytics

Industry Partner Analytics

Procurement Analytics

IT Resource Analytics

HR Analytics

Data Analyst Training

Learning Analytics

Awareness Training

Student Analytics

Graduate Analytics

Visual Analytics Training

TEMASEK POLYTECHNIC

Early Learning Analytics Project

- Developed and launched in 2014

- A front-end self-service analytics tool for School Directors and Course Manager to gain academic insights – on **course** and **subject** performance
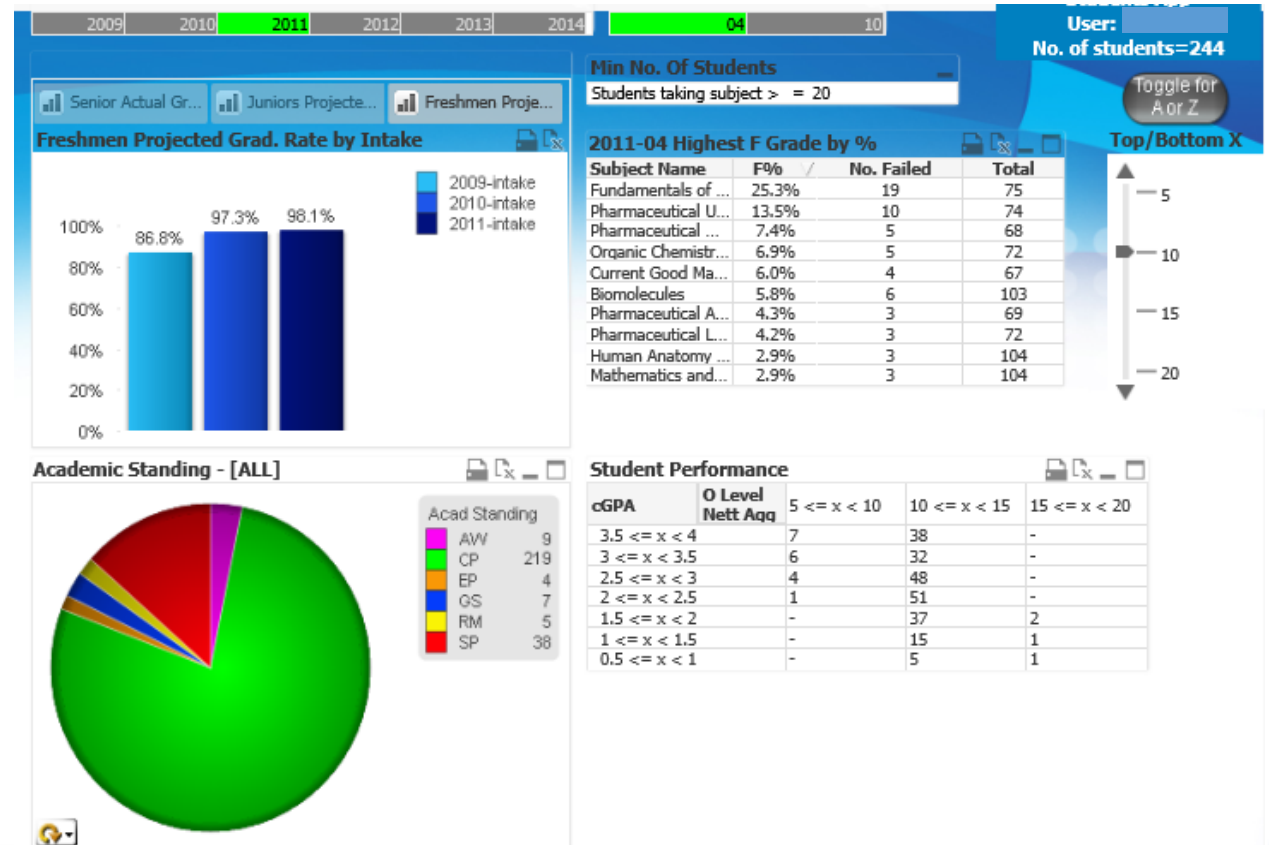
Capability Development

Capability Development

- Start from basic : Awareness

- Classroom learning

- eLearning

- On-the-job-training

- Certification

- Community of Practice (CoP)

- Knowledge Sharing

Challenges

Challenges

Data sources and Quality

- Structured vs unstructured data
- Data consistency
- Data quality is important in producing meaningful results

Competency Building

- Steep Learning Curve
- Lack of skilled personnel in business analytics
- Collaboration with domain experts and IT application teams

Familiarisation with tools

- New analytical tools and systems
- Different tools for different roles - Backend, frontend, Administration

Challenges

Change Management

- Different mindset – data-driven decision making
- Strategic vs operation
- Descriptive to Predictive analytics

System Performance

- Reasonable loading and response time
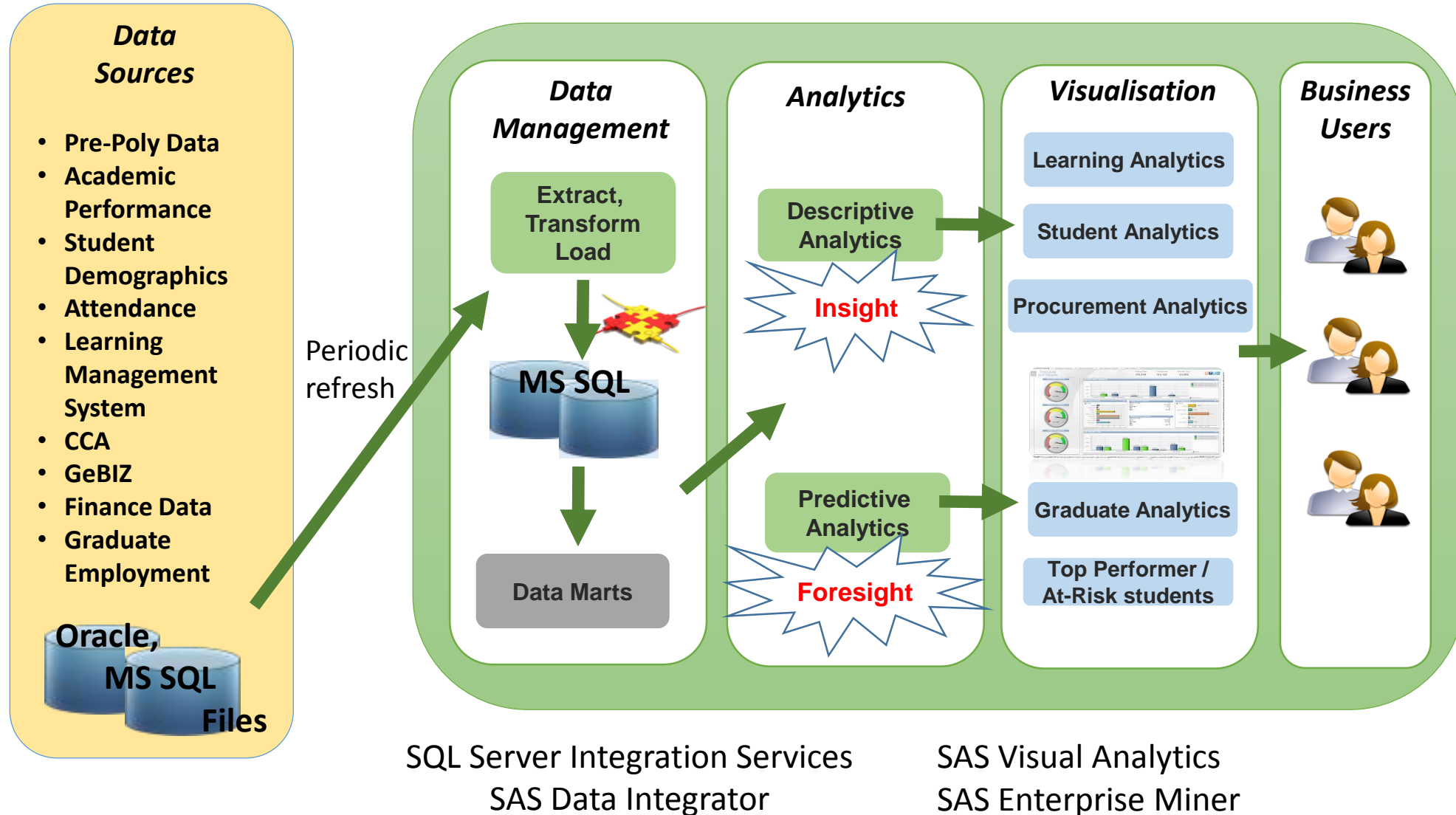- Drill down, drill through
- Data size does matter

Access Control

- Different from transaction system
- Aggregated data
- Open for self-service

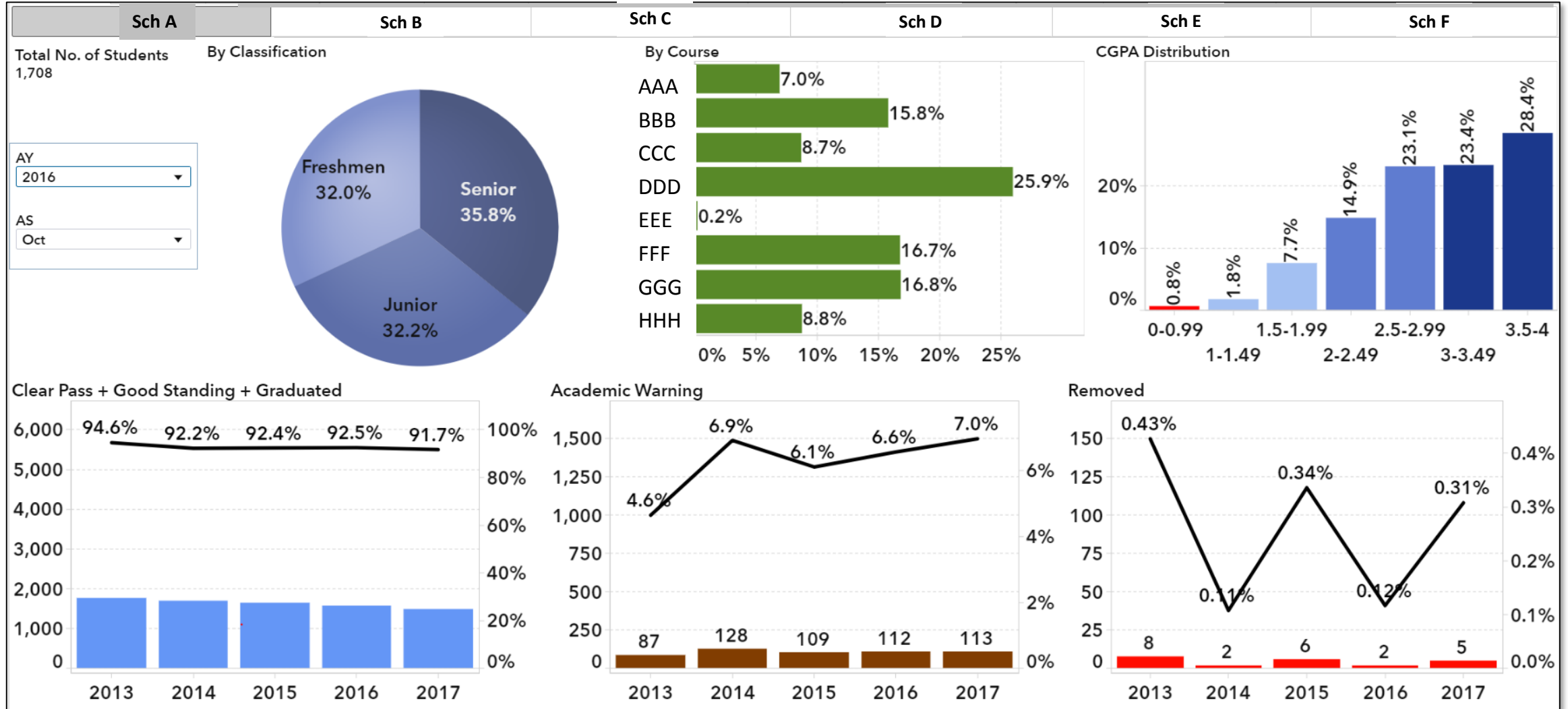# Sample of Data Products

Student Analytics

Conceptual Architecture

Data Sources

- **Pre-Poly Data**
- **Academic Performance**
- **Student Demographics**
- **Attendance**
- **Learning Management System**
- **CCA**
- **GeBIZ**
- **Finance Data**
- **Graduate Employment**

Oracle, MS SQL Files

Periodic refresh

Data Management

Extract, Transform Load

MS SQL

Data Marts

Analytics

Descriptive Analytics

Insight

Predictive Analytics

Foresight

Visualisation

Learning Analytics

Student Analytics

Procurement Analytics

Graduate Analytics

Top Performer / At-Risk students

Business Users

SQL Server Integration Services
SAS Data Integrator

SAS Visual Analytics
SAS Enterprise Miner

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Student Analytics

- Student Academic Performance
- Reports for BOE (Board of Examiners)
- Graduation & Attrition
- Comparison by Admission Category / Entry Qualification
- 5-year Trend
- Comparison by Predictive Analytics – Top Performer / At Risks

School BOE Report

Graduation/Attrition Report

Admission Category
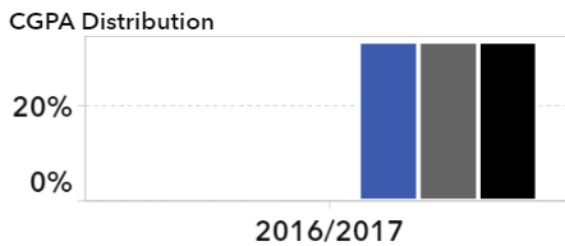
Intake Year	School	Course
2016/2017 ▼	▼	▼

Intake Number and Percentage

Adm Cat Code ▲	Intake No.	Intake %
DAE	25	9.2%
DPA	4	1.5%
ISAE	3	1.1%
JAE	199	73.2%
JPAE	25	9.2%
JPSAE	16	5.9%
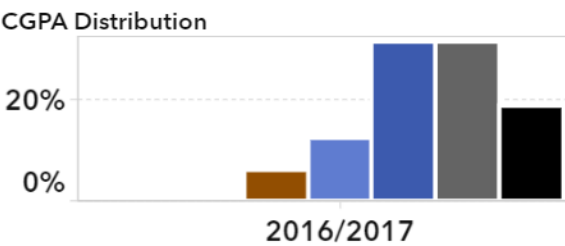
ISAE ▼   JPSAE ▼

CGPA Distribution

CGPA Distribution

2016/2017   2016/2017
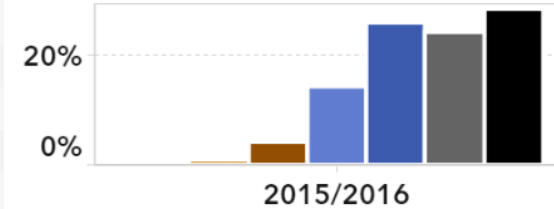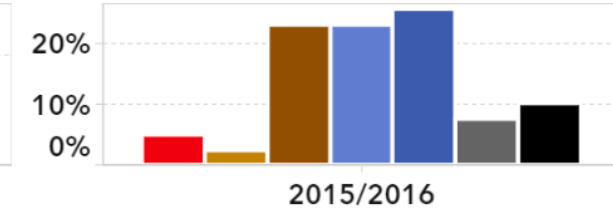
Admission Category Code

- ☐ DAE
- ☐ DPA
- ☐ EAE
- ☐ ISAE
- ☐ JAE
- ☐ JPAE
- ☐ JPSAE

Academic Warning and Removal for this Semester

- DAE   0.0%   4.0%
- DPA   0.0% 0.0%
- EAE
- ISAE   0.0% 0.0%
- JAE   1.5% 0.0%
- JPAE   0.0% 0.0%

Withdrawal (Cumulative)

Adm Cat Code ▲	Withdrawal No.	Withdrawal %
DAE	0	0.0%
DPA	0	0.0%
ISAE	0	0.0%
JAE	0	0.0%
JPAE	1	4.0%
JPSAE	0	0.0%

Removal (Cumulative)

| Adm Cat Code ▲	Removal No.	Removal %
DAE	1	4.0%

Entry Qualification

Predictive Analytics

Predictive models were built **for** *students' performance* **to enable** *proactive*
actions on semester basis for individual schools/diplomas

Predict Students' Performance

At the end of a student's academic career with TP, will he/she become
1. **top performer** (top 25%) 2.**at-risk** (bottom 25%) 3. **graduate within normal duration**?

On-Time Graduation	Performance	
	Top Performer	At - Risk
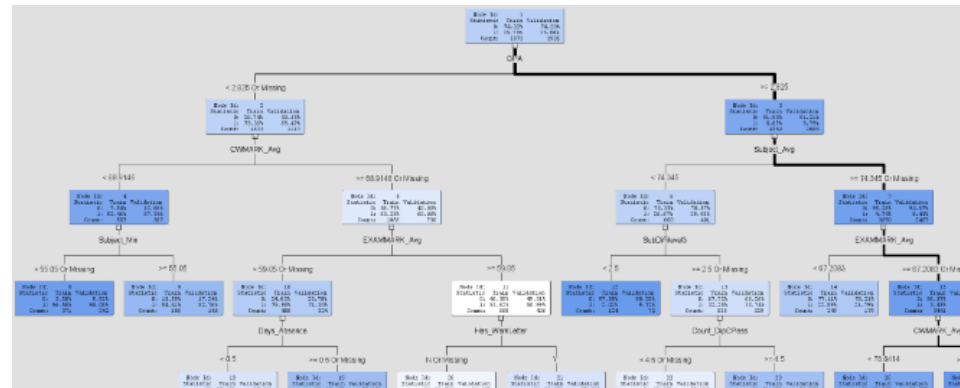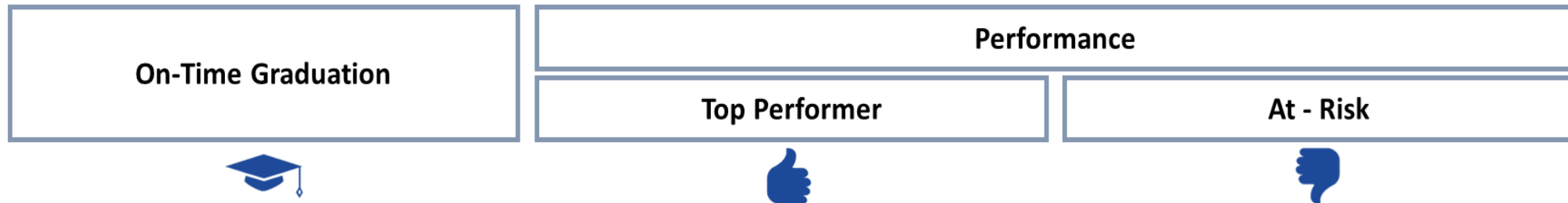
Sample of Data Products

Learning Analytics

Learning Analytics

- Support Learning Intervention and Enculturate Reflective Practice

- How long did students engage with online content?
- What is the level of student engagement in the online discussion forum?

LMS Content Access

Filters

Students' Access Patterns

Student Workload Distribution
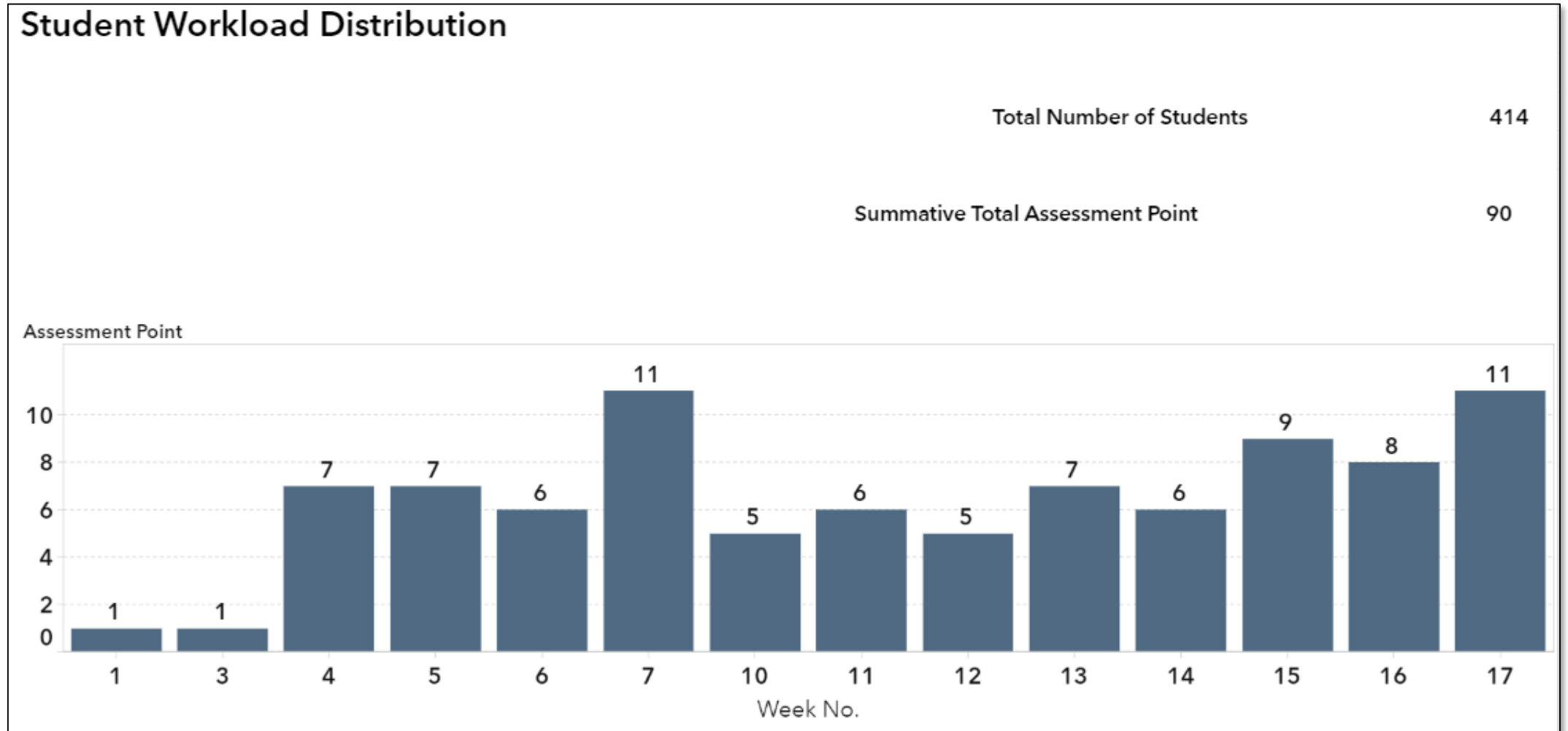
Sample of Data Products

Graduate Analytics

Graduate Analytics

To distil key drivers for graduates' outlook to enable personalised interventions

**Predict
Graduates' Outlook**

Will the graduate be
☐ economically active?
☐ working in field related to studies?
☐ engaged in further study?
☐ etc.

**Distil underlying
Key Drivers**

☐ Demographic
☐ Entry Qualification
☐ Academic Performance
☐ Financial
☐ etc.

**Enable Intervention
(every semester or as needed)**

☐ Generate propensity of students at the end of each semester for 'personalised' interventions

Input Considerations

Temasek POLYTECHNIC

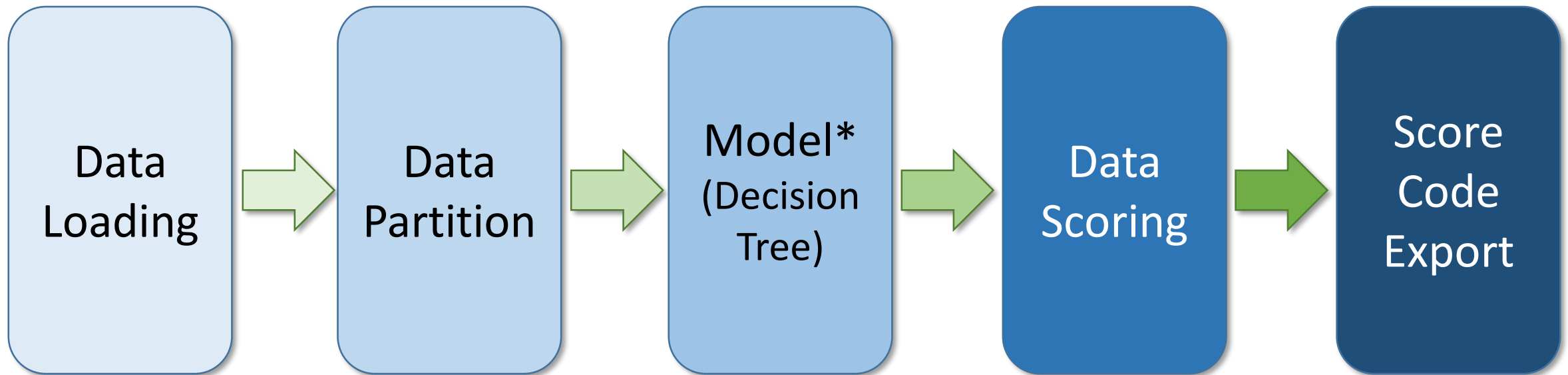*Utilise data in* *TP source systems* *to study students' behaviour comprehensively*

Demographics	Entry Qualification	Academic Performance	Financial	Non-academic	Disciplinary / Attendance
• Age • Citizenship • Gender • etc.	• Admission Category Group • Choice Order • Entry Qualification • etc.	• Core / Elective / CDS Subjects passed / failed • GPA • Subject Marks • etc.	• Award / Bursary • PCI Range • etc.	• CCA points	• Disciplinary Record • Exam MC • Leave Days • etc.

Model Building

Data Loading → **Data Partition** → **Model*** **(Decision Tree)** → **Data Scoring** → **Score Code Export**

- Historical data
- Drop unnecessary variables

- Configure the % of training and validation data

- Determine model(s) with the best balanced outcome

- Run the model with the validation data

- Deployment of code
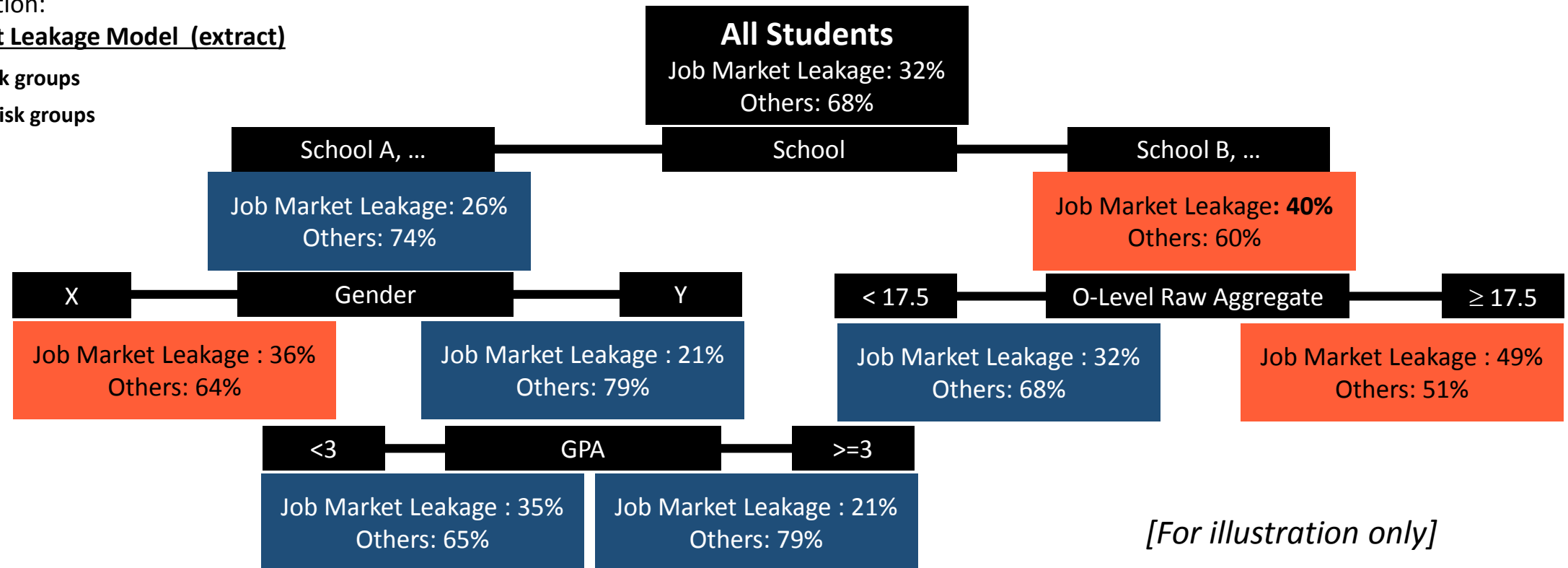
Key Modelling Methodology

Decision Tree
widely used by organisations for its intuitiveness and business interpretability

For Illustration:
Job Market Leakage Model (extract)

- 🟧 **High-risk groups**
- 🟦 **Lower-risk groups**

All Students
Job Market Leakage: 32%
Others: 68%

School

School A, …

Job Market Leakage: 26%
Others: 74%

School B, …

Job Market Leakage: **40%**
Others: 60%

Gender

X

Y

O-Level Raw Aggregate

< 17.5

≥ 17.5

Job Market Leakage : 36%
Others: 64%

Job Market Leakage : 21%
Others: 79%

Job Market Leakage : 32%
Others: 68%

Job Market Leakage : 49%
Others: 51%

GPA

<3

>=3

Job Market Leakage : 35%
Others: 65%

Job Market Leakage : 21%
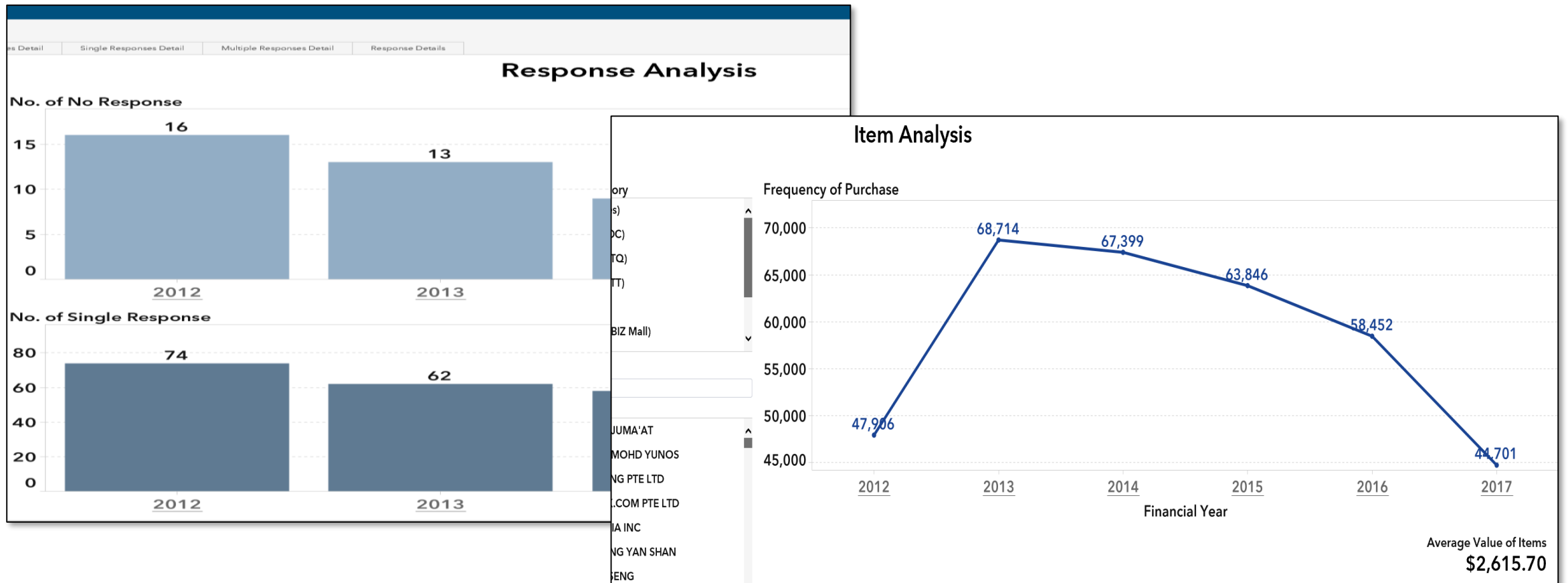Others: 79%

[For illustration only]

Sample of Data Products

Procurement Analytics

Procurement Analytics

- No response or single response ? Specification too stringent or geared towards a particular brand of item?

- Frequency of purchase for specific item ? Spending patterns ?

Procurement Analytics – Alerts & Audit

- **Alert** functionality - prompt relevant stakeholders to review the data so that necessary **intervention** can be considered at different stages of the procurement process.

- Apart from intervention, information gathered can also be used for **audit** function.

Text Analytics

Text Analytics - Project Background

- **TP conducts various surveys**
  - Teaching Effectiveness, Subject Review, Course Review

- **Extensive analysis of quantitative data**

- **Eyeball qualitative data**
  - E.g. Online Student Evaluation of Teaching (OnSET) collects about 100,000 free-text comments annually

Objective

Leverage on technology to analyse free-text comments, so as to gain insights on themes and sentiments

Key Advantage: Categorization

Benefits of Text Analytics

- Convert open-ended comments into meaningful themes and quantifiable results

- Automate comment processing, saving time and resources

- Leverage on the purpose-built 'Teaching and Learning Dictionary'

- Obtain a more complete picture of what students are saying

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Text Analytics

- Cross-tabulation: Qualitative & Quantitative
- Provide better insights

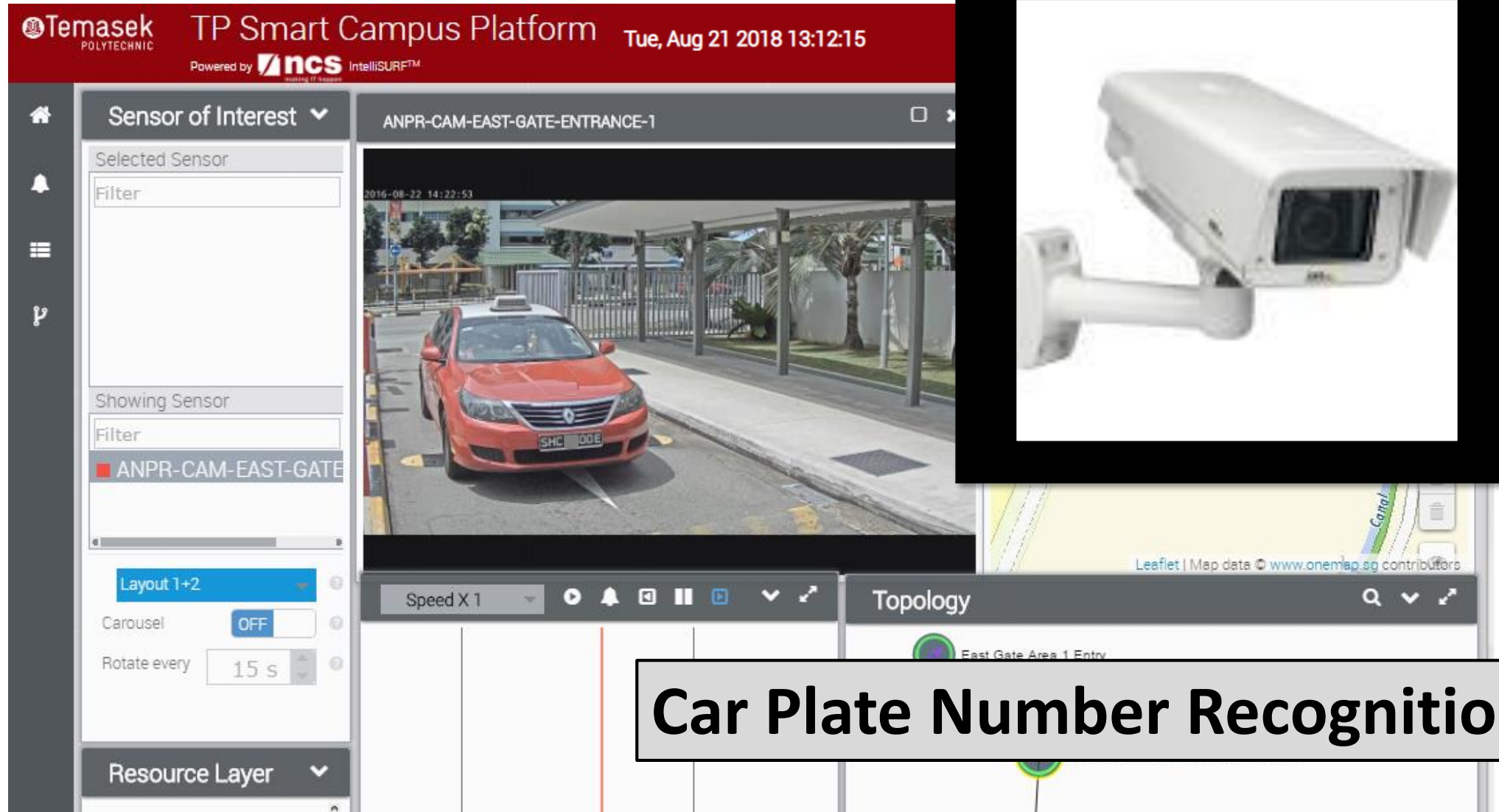**Q11: Write down something that your lecturer has done especially well**

Female students reflect more positively on the learning experience. Key insights for further research:

- *Are there more female faculty?*
- *Are there more female students?*
- *What is the graduation rate for females?*
- *What is the employability rate for females?*
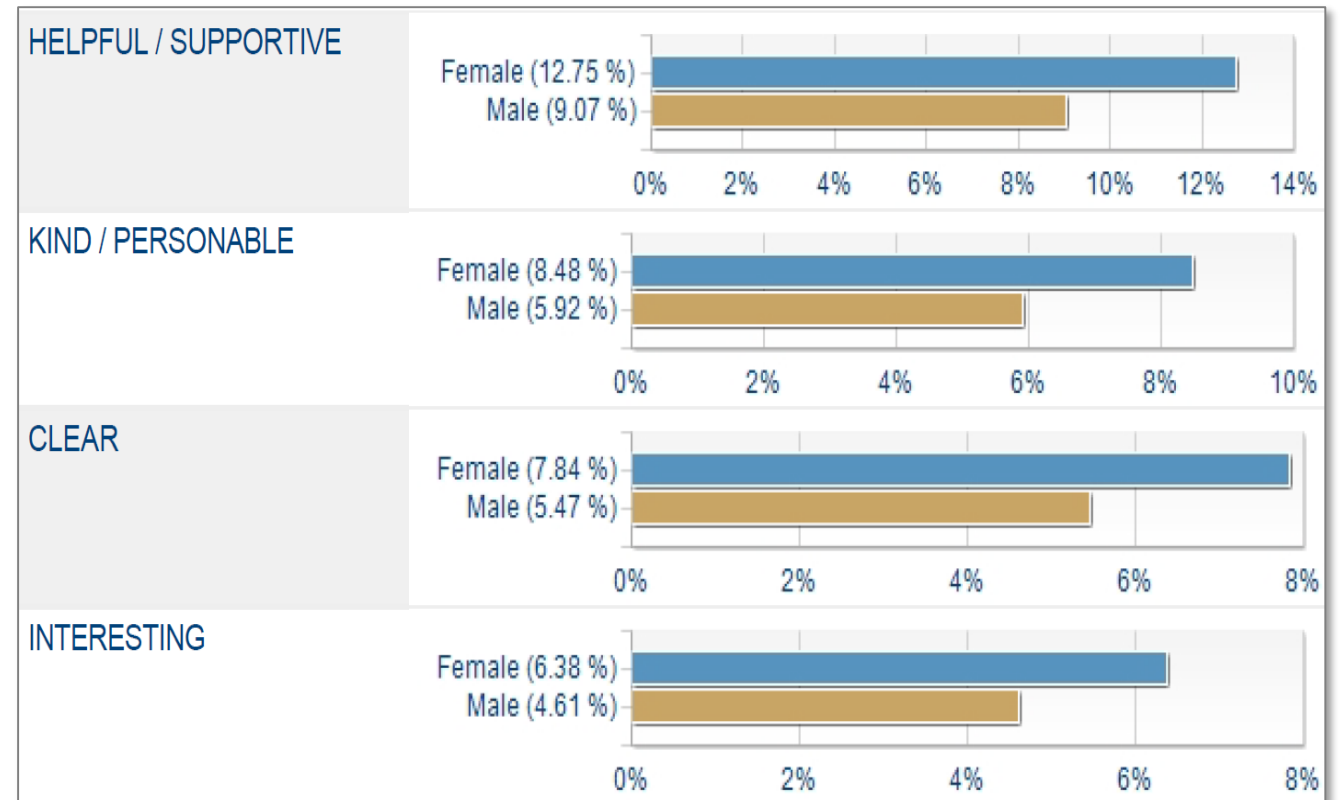
IoT Analytics

Video Analytics

Car Plate Number Recognition

Video Analytics
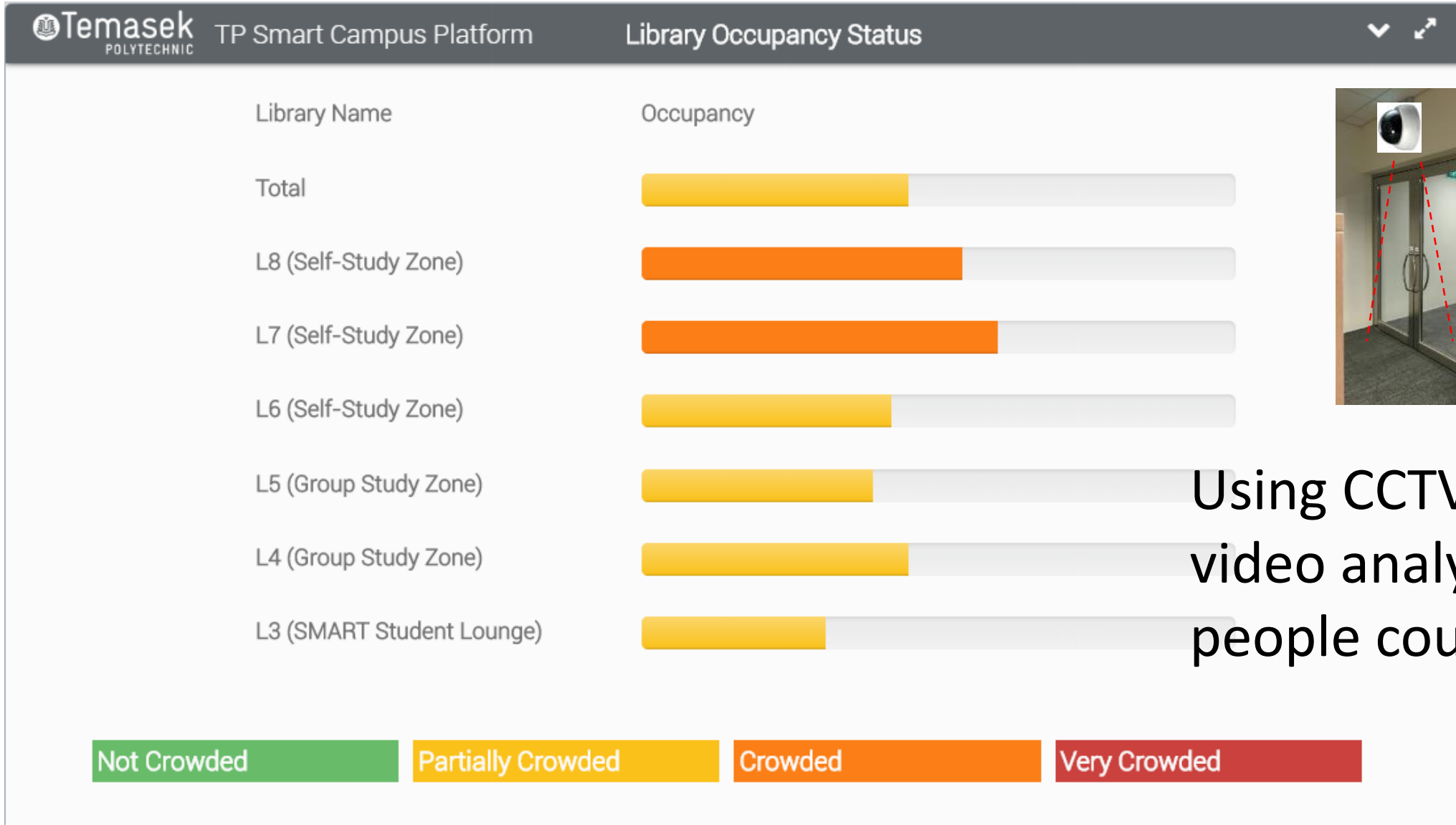
Using CCTVs and video analytics for people counting.

Analytics with IoT Sensors

- Environment – Temperature, CO2, PMI sensors
- Carpark Occupation/Utilisation – carpark sensors
- Energy Management – Smart Distribution Box
- etc

Summary

Summary

Our journey continues…

Thank you !