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Institutional Research Institute 2015

Data analytics, student success indicators and modelling

Glen Barnes

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Introduction

Analytics in Higher Education and in SA Higher Education

- *What is BI / Analytics*
  - Analytic maturity
  - Advanced analytics and BI
  - Competing on analytics
- *Analytics in HE (research results)*
- *Why the limited uptake of BI in HE?*
- *Monitoring performance?*

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What is BI vs analytics?

BI means different things to different people and organisations. An internet search would probably return as many definitions of 'business intelligence' as one could imagine, each highlighting various advantages and disadvantages

Evidence-based decision-making and the processes that gather, present, and use that evidence base.

Evidence : Data vs Digital

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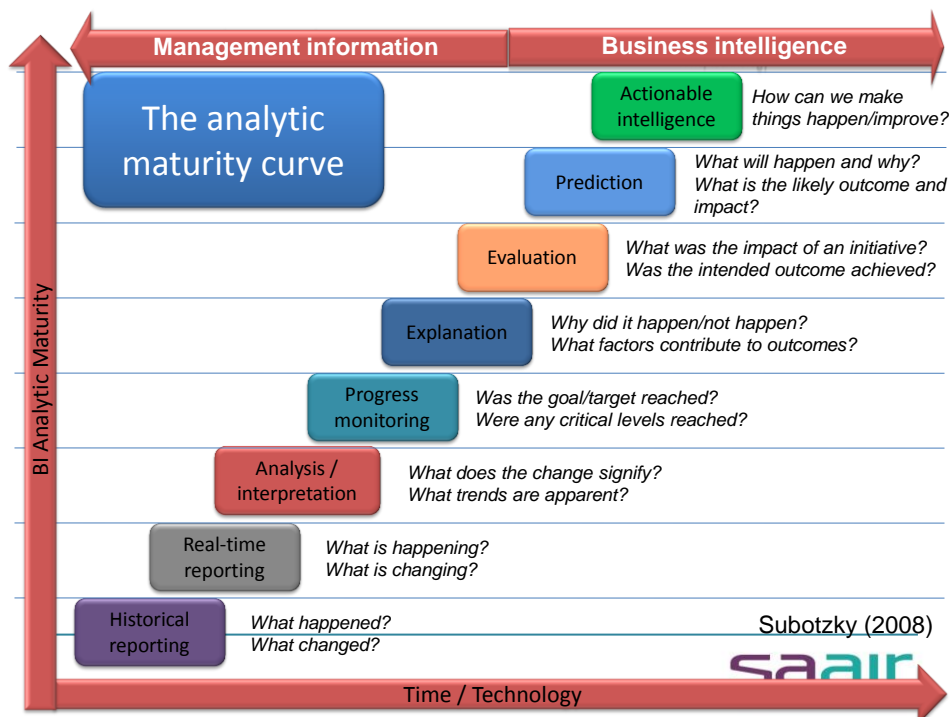
Why is it important?

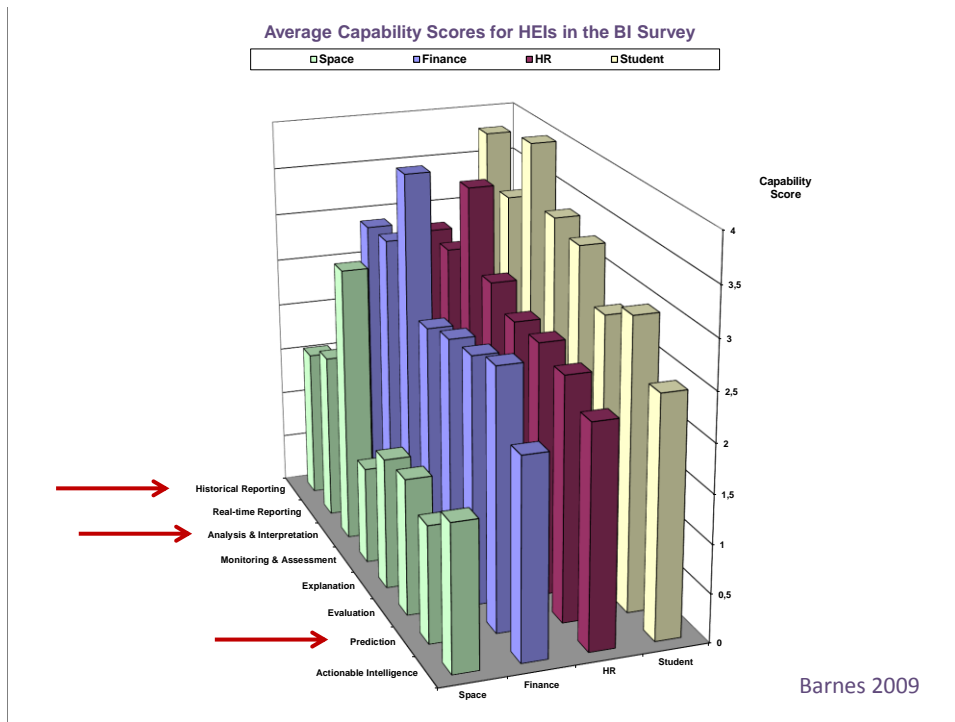An effective business intelligence solution can be used to:

- Provide insight and measurement regarding strategic and tactical efforts
- Provide the ability to see the big picture and to find the "needle in the haystack"
- Support fact-based decision making
- Provide rapid feedback regarding actions
- Validate or discredit assumptions
- Discover non-intuitive relationships

Sharman, 2010

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The analytic maturity curve

Management information | **Business intelligence**

Level	Question
Actionable intelligence	*How can we make things happen/improve?*
Prediction	*What will happen and why? What is the likely outcome and impact?*
Evaluation	*What was the impact of an initiative? Was the intended outcome achieved?*
Explanation	*Why did it happen/not happen? What factors contribute to outcomes?*
Progress monitoring	*Was the goal/target reached? Were any critical levels reached?*
Analysis / interpretation	*What does the change signify? What trends are apparent?*
Real-time reporting	*What is happening? What is changing?*
Historical reporting	*What happened? What changed?*

BI Analytic Maturity

Time / Technology

Subotzky (2008)

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Barnes 2009

Competing on analytics

- Davenport & Harris (2007)
  - Businesses going the route of competing on analytics
  - Considered the pathways of adoption by successful companies
  - Identified the stages towards being "Analytical competitors"

  - Some resonance with HE
  - One difference would be the middle management response/uptake
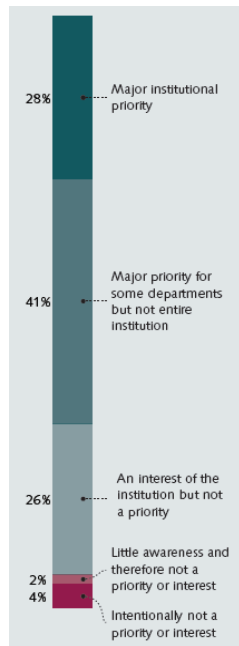
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Davenport & Harris, 2007
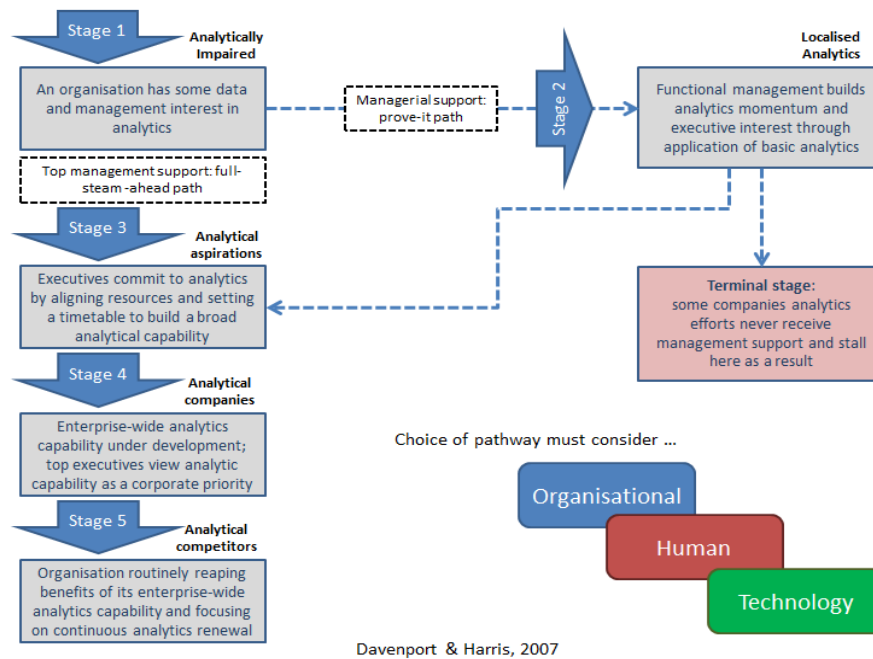
Analytics research in HE

Jaqueline Bichsel, 2012

- – Survey of a number of institutions with membership of EDUCAUSE and AIR
- – 339 distinct respondents
- – Only looking at:
  - Priority of analytics
  - Targets and benefits
  - What is in place
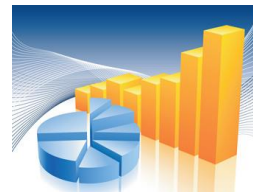
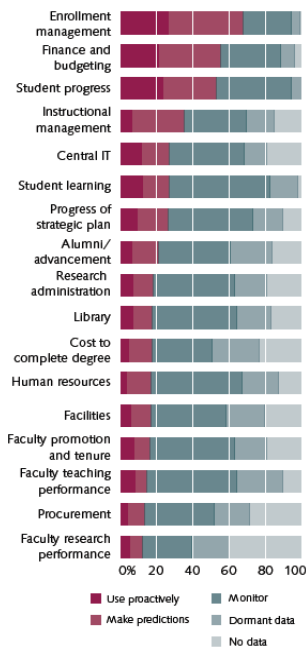Priority of analytics in the institution   (Bichsel, 2012)

Only 28% of the respondents viewed analytics as being the major priority in the institution.

41% viewed analytics as being a high priority in some departments but not the entire institution.

Only 6% regarded this as low priority or no interest at all.

Targets and benefits of analytics   (Bichsel, 2012)

Survey respondents were asked how they use data in various functional areas.

Only three areas (enrolment management, finance and budgeting and student progress) have the use of analytics at the highest levels (proactive and predictive capabilities).

Interesting to note that student learning, and progress of strategy are midway on the list.

Research administration, faculty teaching performance, faculty research performance are way low on the results, considering these underpin the core business of HE.

Also interesting are the areas with NO DATA.

What is in place for analytics (Bichsel, 2012)
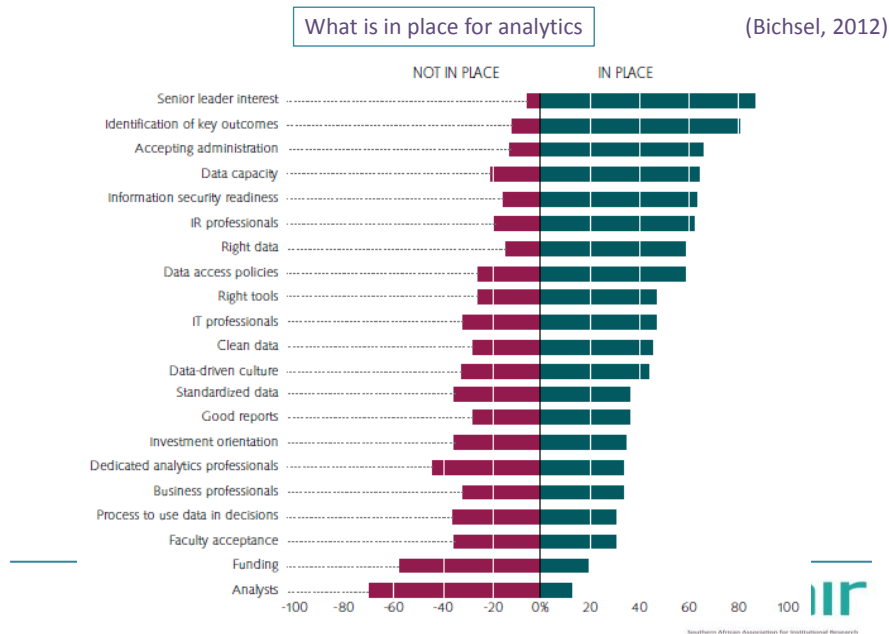
Where do we feature in SA?

- Not much research on this topic in SA

- Exposure to universities in SA and beyond …
  - Structure and function of MI and BI units
  - External reviews of MI units
  - HE task teams on analytics
  - Consulting to MI & IR units to undertake
    - Analytics, IR, MI and BI

Where do we feature in SA?

- Not very different from the results of Bichsel
  - The diversity of analytic capability is more marked
  - The difference between the leading and the rest is large
  - The analytic capability restricted to a few functions
- There are institutions with:
  - Regular KPIs to Excom / Council – *balanced / institutional?*
  - Measuring performance routinely – *institutional vs individual/unit?*
  - Predictive capabilities used proactively – *student / finance?*
  - Early alert systems in place – *interventions / effective?*
  - Advanced analytics in place (risk, modelling, mining) – *effective?*
  - Adding 'soft metrics' to the data set – *skills, habits, behaviours?*

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Where do we feature in SA?

- Still many that are …
  - Stuck in the routine of operational reporting
  - Battling with fully automated extractions - ETL
  - The manipulation of data from disparate (*desperate*) sources
  - Struggling to get consistency in data and a common granularity
  - Struggling to be visible and effective
  - The preference to invest in tools and not people / process
- Still battle to …
  - Integrate data → information → knowledge – *too much!!*

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Why the limited uptake of BI in HE?

- Silos of data, information and power
- BI is the 'nice-to-have' and not the 'have-to-have'
- The BI development cycle
  - SS must provide MI
  - User needs and comprehension
  - Development skills and ability
- The analytic team
  - The team is not visible
  - Data are not reliable or accurate
  - Data are too complex and not integrated
  - Clients are intimidated
- The costs of BI

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Why the limited uptake of BI in HE?

- *Uneven uptake in the institution*
  - *High Executive buy-in*
  - *Low Programme manager / co-ordinator uptake*
- *Up until recently - limited or no consequence*
- *Limited investment in process and people*
- *Self-help BI is a myth …*
  - *Complex vs comprehensive*
  - *Expect too much from the client?*
  - *The existence and role of the 'data scientist'*

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Where to from here?

Effective analytics is more about people and process than data and tools !

Advanced analytics …

Monitoring performance …

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Advanced analytics

- What are these?
  - Ratio analysis – Income patterns, distribution patterns, etc
  - Modelling – Inflow / Outflow modelling for enrolment plans, Space modelling to norms, input / output models, viability models
  - Data Mining – Identifying hidden success trends from student metrics
  - Advanced Statistical analyses – Tree, CHAID, Logistic, etc
  - Predictive analytics – Enrolment patterns, student success, risk, etc
  - Scenario analyses – Impact of interventions, historical patterns
  - Monitoring & Evaluation – Progress against targets, effect of decisions

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Monitoring performance

Institutional performance
- – Strategy mapping
- – Performance indicators
- – Scorecards
- – Reporting and dissemination
- – Audience and maturity

Unit performance
- – align business units to the institution

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Translating a Mission into Desired Outcomes*

Mission - Why do we exist?
Core Values - What do we believe in?
Vision - What do we want to be?
Strategy - What is our game plan?
Balanced Scorecard - How do we implement & focus?
Strategic Initiatives - What do we need to do?
Personal Objectives - What do I need to do?

Strategic Outcomes

| Satisfied Shareholders | Delighted Customers | Effective Processes | Motivated & Prepared Workforce |

* Adapted from Kaplan & Norton Figure 3-2, page 73.

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The Balanced Scorecard Generic Strategy Map*

Improve Shareholder Value

Financial Perspective — Revenue Growth Strategy | Shareholder Value ROCE | Productivity Strategy

Build Franchise | Increase Customer Value | Improve Cost Structure | Improve Asset Utilization

New Revenue Sources | Customer Profitability | Cost Per Unit | Asset Utilization

Customer Acquisition | Customer Retention

Customer Value Perspective — Product Leadership | Customer Intimacy | Operational Excellence

Customer Value Proposition

Product/Service Attributes | Relationship | Image

Price | Quality | Time | Functionality | Service | Relationships | Brand

Customer Satisfaction

Internal Perspective — "Build the Franchise" (Innovation Processes) | "Increase Custormer Value" (Customer Managegment Processes) | "Achieve Operational Excellence" (Operational Processes) | "Be a Good Corporate Citizen" (Environmental Processes)

Learning and Growth Perspective — A Motivated and Prepared Workforce

Strategy Competencies | Strategic Technologies | Climate for Action
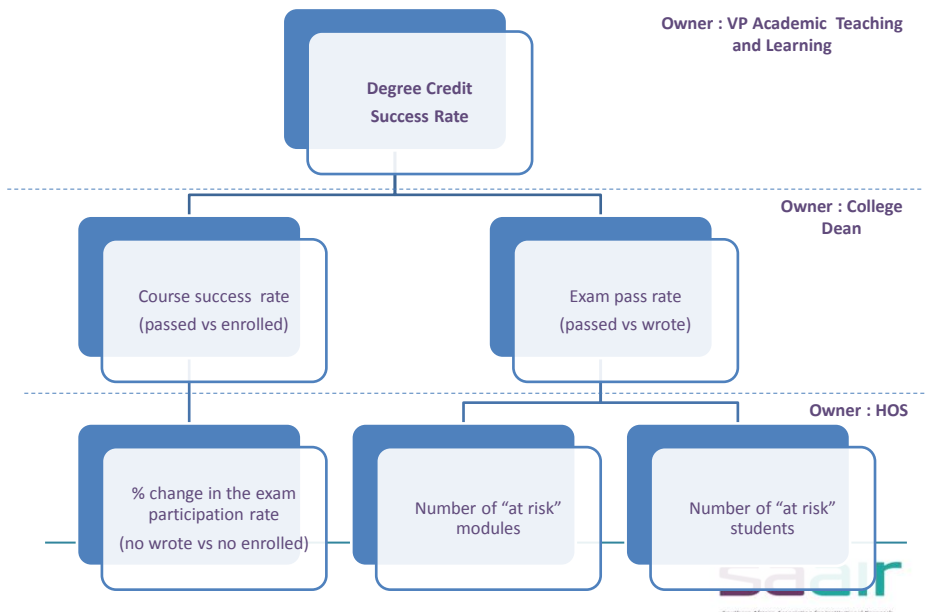
* Adapted from Kaplan & Norton Figure 3-15 page 96.

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Goal 1: Undergraduate student performance

Owner : VP Academic Teaching and Learning

Degree Credit Success Rate

Owner : College Dean

Course success rate (passed vs enrolled)

Exam pass rate (passed vs wrote)

Owner : HOS

% change in the exam participation rate (no wrote vs no enrolled)

Number of "at risk" modules

Number of "at risk" students

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Measure, Monitor & Report

- List of indicators
  - Council
  - Portfolio
  - College / Department
  - School / Unit
- Contributors, dependencies, weightings
- Assessment against targets and benchmarks
- Scorecards
- Reporting
  - Narrative report
  - Infographic report

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List of Indicators

ID No	PI No	Performance Indicator	KPI Info	Act Wght	Benchmark (BM) Contributors	⬇
PI 4: UG Degree Credit Success Rate						
224	4.1	**Exam Admission Rate** *PI Comment*: % of students that wrote vs admitted for the module per sitting *Data Definitions*: number wrote vs number admitted. Data are Exam_Sitting=6, 10; Formal=Formal; Academic_Level=UnderGraduate *Data Source*: Examination data	✓	✓ 1	97-98% ✗	☐
223	4.2	**Exam Participation Rate** *PI Comment*: % of students that wrote vs registered for the module per sitting *Data Definitions*: number wrote vs number registered *Data Source*: Examination data	✓	✓ 1	93% to 95% ✗	☐
222	4.3	**Exam Pass Rate** *PI Comment*: % of students passed vs wrote for the module per sitting *Data Definitions*: number passed vs number wrote *Data Source*: Examination data	✓	✓ 1	A minimum of 67% ✗	☐
221	4.5	**Course Success Rate** *PI Comment*: % of students passed vs registered for the module per academic period *Data Definitions*: number passed vs number registered *Data Source*: Examination data	✓	✓ 1	63% by 2015 ✗	☐
225	4.6	**Proportion of At Risk Students** *PI Comment*: % of students that are classified with a risk rating above x *Data Definitions*: (still to be defined) *Data Source*: Student Risk Modelling	✓	✗ 1	✗	☐
226	4.7	**Proportion of At Risk UG Modules** *PI Comment*: % of UG modules that are classified as At Risk *Data Definitions*: A count of number of UG, formal modules classified as At-Risk in any year relative to all the UG formal modules in that year *Data Source*: Module Risk Modelling	✓	✓ 1	Below 15% ✗	☐

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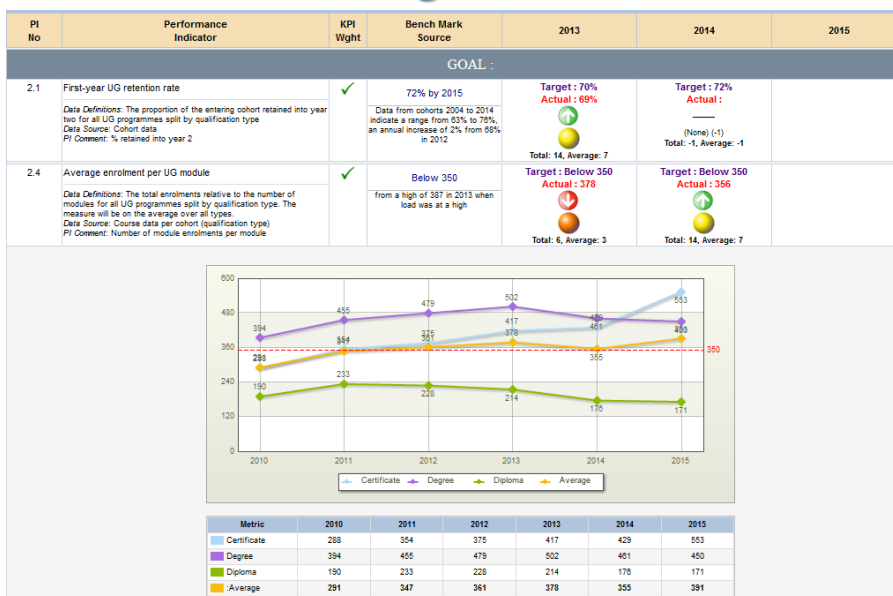Southern African Association for Institutional Research

Indicator List

- Indicator definition – interpretation
- Data definitions – accuracy
- Define the data source – consistency
- Set benchmarks – base line and trajectory
- Contributors – aggregated measures
- Weightings – impact and importance
- Leading & lagging – mixture of these, leading are key
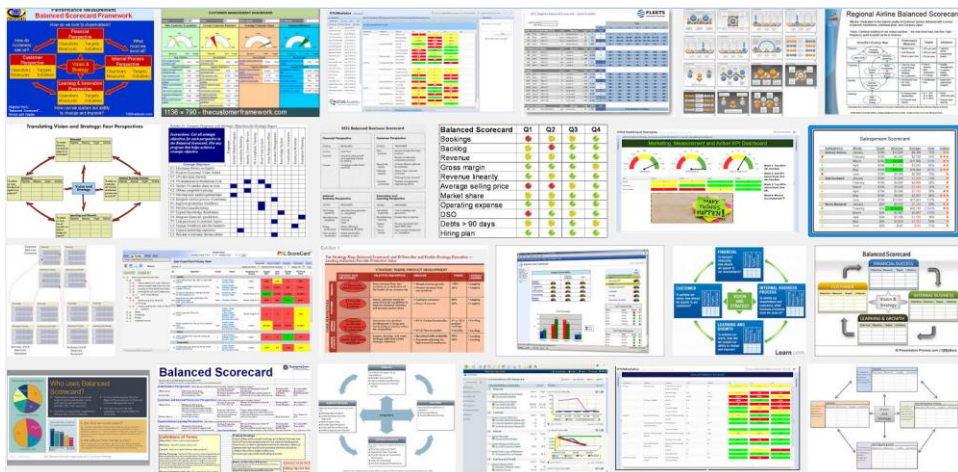- Dependencies – double measure

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Monitoring & Evaluation

PI No	Performance Indicator	KPI Wght	Bench Mark Source	2013	2014	2015
			GOAL :			
2.1	First-year UG retention rate	✓	72% by 2015	Target : 70% Actual : 69%	Target : 72% Actual :	
	Data Definitions: The proportion of the entering cohort retained into year two for all UG programmes split by qualification type. *Data Source*: Cohort data *PI Comment*: % retained into year 2		Data from cohorts 2004 to 2014 indicate a range from 63% to 76%, an annual increase of 2% from 68% in 2012	↑ 🟡 Total: 14, Average: 7	—— (None) (-1) Total: -1, Average: -1	
2.4	Average enrolment per UG module	✓	Below 350	Target : Below 350 Actual : 378	Target : Below 350 Actual : 356	
	Data Definitions: The total enrolments relative to the number of modules for all UG programmes split by qualification type. The measure will be on the average over all types. *Data Source*: Course data per cohort (qualification type) *PI Comment*: Number of module enrolments per module		from a high of 387 in 2013 when load was at a high	↓ 🔴 Total: 6, Average: 3	↑ 🟡 Total: 14, Average: 7	

Metric	2010	2011	2012	2013	2014	2015
Certificate	288	354	375	417	429	553
Degree	394	455	479	502	461	450
Diploma	190	233	228	214	176	171
:Average	291	347	361	378	355	391

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Monitoring & Evaluation

- Set annual targets – trajectory & milestones
- Measure metric movement – trend analysis
- Attainment of the annual target – progress
- 'Prognosis' of attaining the benchmark – forward looking
- Conversion to a score – create a 'common currency'
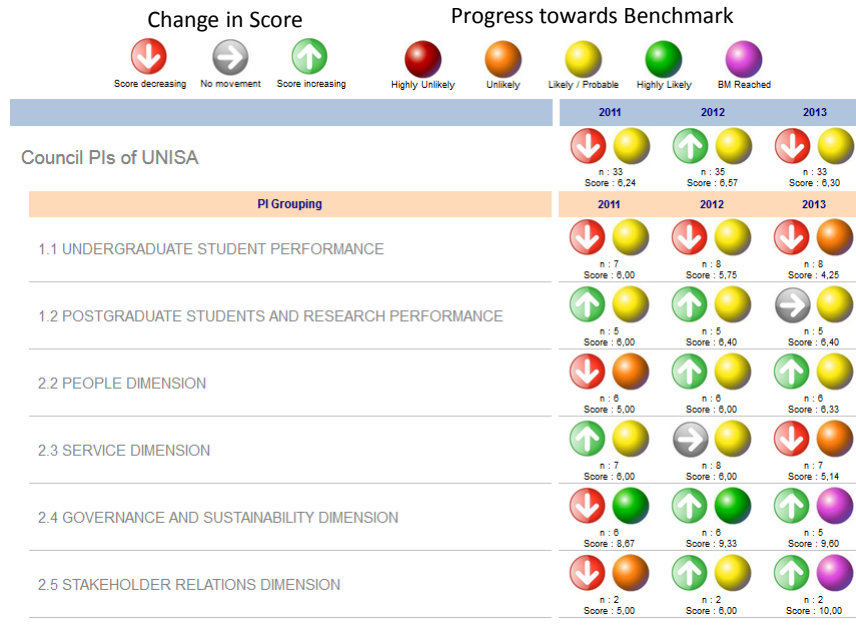- Display details – visualisation
- Automation …

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Scorecards

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Scorecards

- Two approaches:
  - Retain 6 to 10 key indicators and monitor the changes over time, display in a dashboard

  - Identify a large number of indicators that measure many aspects of the business and aggregate or disaggregate the results

Change in Score

Score decreasing | No movement | Score increasing

Progress towards Benchmark

Highly Unlikely | Unlikely | Likely / Probable | Highly Likely | BM Reached

	2011	2012	2013
Council PIs of UNISA	n : 33 Score : 6,24	n : 35 Score : 6,57	n : 33 Score : 6,30

PI Grouping	2011	2012	2013
1.1 UNDERGRADUATE STUDENT PERFORMANCE	n : 7 Score : 6,00	n : 8 Score : 5,75	n : 8 Score : 4,25
1.2 POSTGRADUATE STUDENTS AND RESEARCH PERFORMANCE	n : 5 Score : 6,00	n : 5 Score : 6,40	n : 5 Score : 6,40
2.2 PEOPLE DIMENSION	n : 6 Score : 5,00	n : 6 Score : 6,00	n : 6 Score : 6,33
2.3 SERVICE DIMENSION	n : 7 Score : 6,00	n : 8 Score : 6,00	n : 7 Score : 5,14
2.4 GOVERNANCE AND SUSTAINABILITY DIMENSION	n : 6 Score : 8,67	n : 6 Score : 9,33	n : 5 Score : 9,60
2.5 STAKEHOLDER RELATIONS DIMENSION	n : 2 Score : 5,00	n : 2 Score : 6,00	n : 2 Score : 10,00

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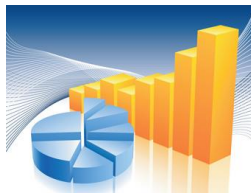Southern African Association for Institutional Research

Challenges

- Appropriate measures – must measure the business
- Continuity – must measure the same thing each iteration
- Accountable, responsible, actionable – must be ownership
- Time – iterative process allowing refinement
- Aligning all levels of the institution – marrying institutional and personal performance
- Audience maturity – time and effort to change behaviour

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The future Council / Mancom chambers …

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LEADING INDICATORS

Leading indicators are *process measures that help you gauge incremental progress you are* making toward key HR outcome (lagging) measures.

➢ Since leading indicators measure the results from your processes, there is less of a delay between your actions and a change in the system.

➢ They are the *performance drivers — the* key factors that enable the overall end result (outcome) you want to achieve.

Non-HR Examples
- Economy — capital equipment purchases, layoffs, stock market value, public confidence, exchange rates, etc.
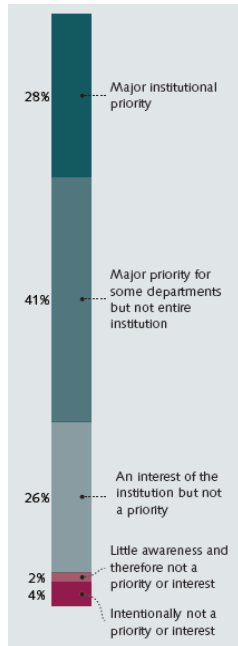
HR Examples
- A reduction in absenteeism in key positions.
- % increase in internal people expressing interest in position

Characteristics
- *Process* measure.
- Immediate feedback to the system.
- Tells you what *is* happening now.
- Can be tracked over time.
- Provides an "early warning" of emerging results.
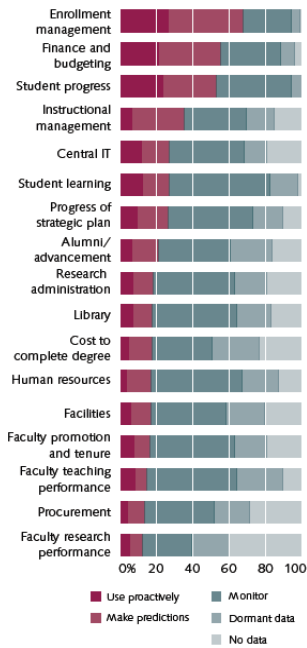- Very responsive to changes in the system

Discussion

- How is your institution placed on:
  - Priority of analytics
  - Targets and benefits
  - What is in place

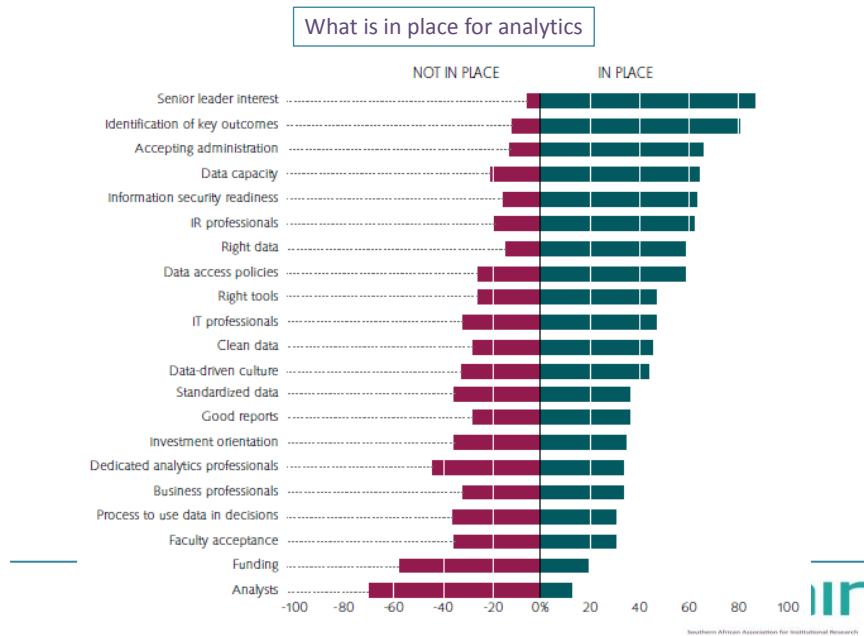- What is the role and extent of modelling in your institution?

Priority of analytics in the institution

28% — Major institutional priority

41% — Major priority for some departments but not entire institution

26% — An interest of the institution but not a priority

2% — Little awareness and therefore not a priority or interest

4% — Intentionally not a priority or interest

Targets and benefits of analytics

- Enrollment management
- Finance and budgeting
- Student progress
- Instructional management
- Central IT
- Student learning
- Progress of strategic plan
- Alumni/ advancement
- Research administration
- Library
- Cost to complete degree
- Human resources
- Facilities
- Faculty promotion and tenure
- Faculty teaching performance
- Procurement
- Faculty research performance

0% 20 40 60 80 100

- Use proactively
- Make predictions
- Monitor
- Dormant data
- No data

What is in place for analytics

Advanced analytics

- Who use these?
  - Ratio analysis – Income patterns, distribution patterns, etc
  - Modelling – Inflow / Outflow modelling for enrolment plans, Space modelling to norms, input / output models, viability models
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  - Predictive analytics – Enrolment patterns, student success, risk, etc
  - Scenario analyses – Impact of interventions, historical patterns
  - Monitoring & Evaluation – Progress against targets, effect of decisions

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Advanced analytics

- Who uses these?
  - KPIs to Excom / Council –
  - Measuring performance routinely –
  - Predictive capabilities used proactively –
  - Early alert systems in place –
  - Advanced analytics in place (risk, modelling, mining) –
  - Adding 'soft metrics' to the data set –

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