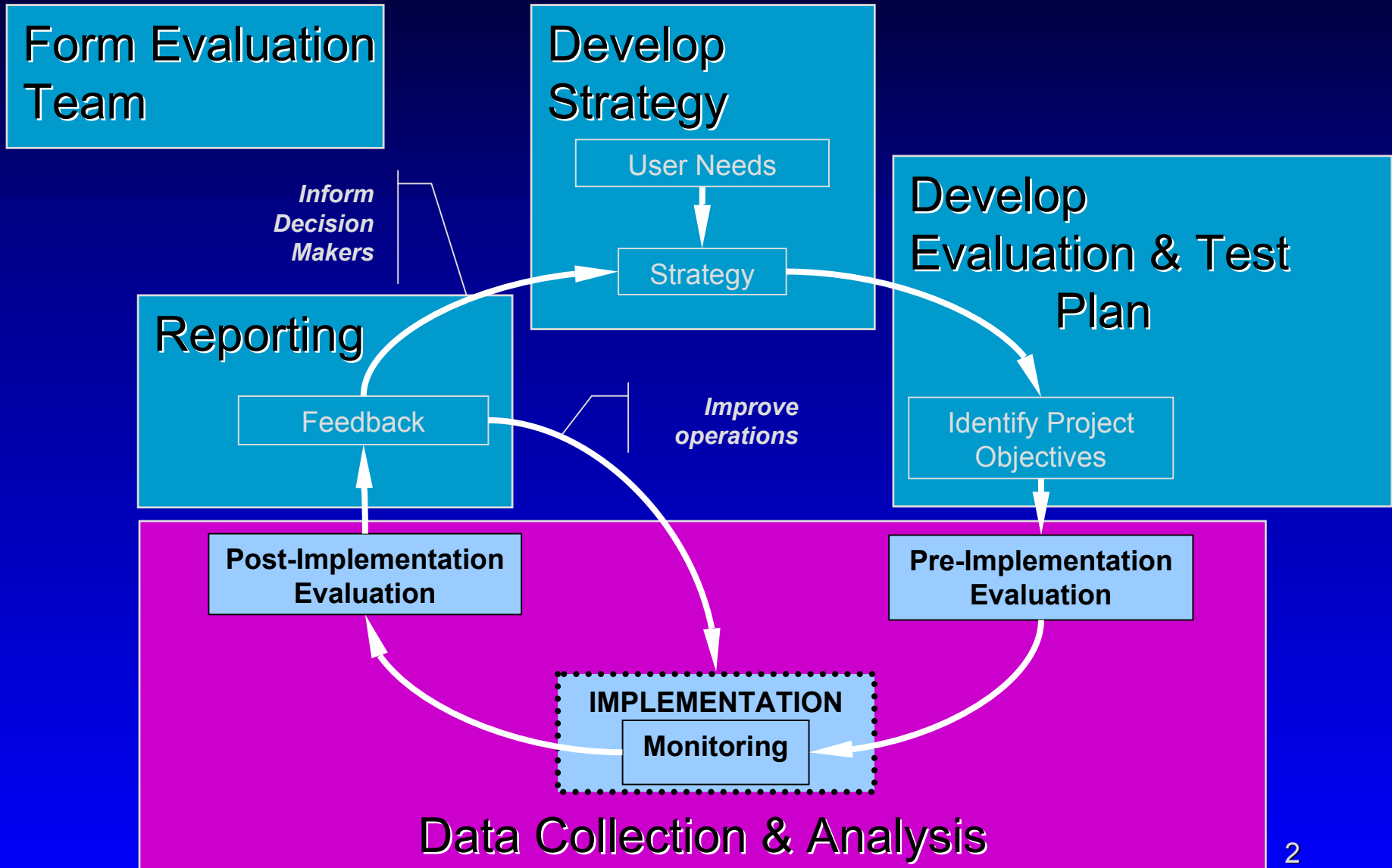


Evaluation Techniques and Performance Measures

Steve Morello

Evaluation Process



Evaluation Tools and Techniques

- There are number of tools and techniques available
 - Document review
 - Field trials / observations
 - Interviews, surveys, etc
 - Simulation / modeling analysis
 - Database analysis (e.g. safety, etc)
 - Risk assessment
 - Benefit / Cost analysis
 - Others?

Document Review

- Review of reports prepared by implementing agencies or independent authorities
- Challenges
 - limited independence
 - no independent baseline data
- Benefits of technique
 - low cost
 - rapid turnaround



Field Trials / Observations

- Involves direct observation over time of conditions before and after implementation
 - Field surveys
 - Video capture
 - Automated data capture from ITS sensors
- Challenges
 - External influences (e.g. weather, incidents)
 - expense
- Benefits of technique
 - independent baseline data



Interviews, Surveys, etc

- Information is collected from a sample of users or beneficiaries of deployment, utilising carefully designed tools and statistically significant samples
- Challenges
 - sample size
 - danger in interpretation of stated preferences
- Benefits of technique
 - scientifically defensible data with relatively limited costs
 - appealing to elected officials



Simulation / Modeling Analysis

- Using computer models to calculate and display the impact of strategies using mathematical models and “real world” data
 - CORSIM, INTEGRATION, VISSIM, SISTM, etc.
- Challenges
 - concerns with accuracy, need to calibrate, validate
- Benefits of technique
 - relatively low cost
 - limited data requirements
 - reasonable estimates of impacts on larger geographical areas, across different modes and over time



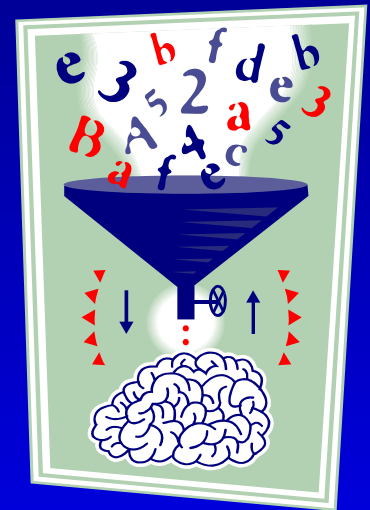
Benefit / Cost Analysis

- Comparison of real world benefits with costs of implementation
- Challenges
 - usually a planning technique, not an evaluation technique
 - value of time is debatable (varies between countries)
 - identifying costs problematic
 - impact of benefits like travel time reliability may be uncertain
- Benefits of technique
 - helps with alternatives analysis



Database Analysis

- Investigation into information stored in large arrays of data, e.g. FARS, NADICS, QMISS
- Challenges
 - need a lot of data
 - data reliability
 - timeliness or “freshness” of data
- Benefits of technique
 - allows longer time frame
 - permits analysis or comparison of multiple locations



Risk Assessment

- Used to evaluate security applications of ITS
- Employed before and after ITS treatments to assess
 - Changes in threat, vulnerabilities, and consequences
- Challenges
 - Requires expert judgment
 - New way of thinking for many transportation professionals
- Benefits of technique
 - In addition to illustrating relative impacts of treatments the technique also helps to identify remaining gaps

Issues Common to all Techniques

- Measurement or Simulation
 - Control
 - Homogeneity
- Special Considerations
 - Conditions of measurement may affect performance
 - Specification or calibration of model may vary in adequacy
 - Measured indicators may be strongly correlated with the parameters which describe conditions
- Issues may be mitigated by careful selection of performance measures

Performance Measures: Overview

- Performance Measures
 - Enable the evaluation of program goals and objectives
 - For example, the desire to reduce congestion
 - How do we know if this is achieved?
 - Through performance measures
- Measures need to be carefully selected
 - Appropriate
 - Understandable
 - Comparable
 - Transferable

What Makes a Good Performance Measure?

- Is accepted by and meaningful to the customer
- Tells how well goals and objectives are being met
- Is simple, understandable, logical, and repeatable
- Shows a trend
- Is unambiguously defined
- Allows for economical data collection
- Is timely
- Is sensitive

Source: *Serving The American Public: Best Practices In Performance Measurement*
(<http://govinfo.library.unt.edu/npr/library/papers/benchmrk/nprbook.html>)

UK Department for Transport Goals and Performance Measures - 1/2

- SAFETY

- Accidents
- Security

- ECONOMY

- Transport Economic Efficiency
- Reliability
- Wider Economic Impacts

- ACCESSIBILITY

- Option values
- Severance
- Access to the Transport System

UK Department for Transport Goals and Measures - 2/2

● ENVIRONMENT

- Noise
- Local Air Quality
- Greenhouse Gases
- Landscape
- Townscape
- Heritage of Historic Resources
- Biodiversity
- Water Environment
- Physical Fitness
- Journey Ambience

● INTEGRATION

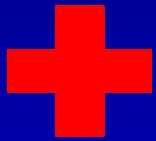
- Transport Interchange
- Land-Use Policy
- Other Government Policies

US National ITS Program Goals and Measures - 1/2

Goal Area

Measure

Safety



Reduction in the overall rate of crashes
Reduction in the rate of crashes resulting in fatalities
Reduction in the rate of crashes resulting in injuries

Mobility



Reduction in travel time delay
Reduction in travel time variability
Improvement in customer satisfaction

US National ITS Program Goals and Measures - 2/2

Goal Area

Measure



Efficiency

Increase in freeway and arterial
throughput



Productivity

Cost savings



Energy and
the Environment

Decrease in vehicle emissions
Decrease in vehicle energy
consumption



Customer Satisfaction is the Bottom Line

Local/Regional Goals and Measures

- Focused on Local Priorities or Special Conditions
 - Travel and tourism
 - Access to special event information
 - Severe weather conditions
 - Timely detection and notification
 - Intermodal freight
 - Reductions in delay for paperwork or inspection
 - Improved identification of high-risk shippers and/or carriers

Surrogate Measures

- It's not always possible to obtain objective measures
- Often we need to use surrogates
 - Safety
 - Have used speed variability as an indicator of crash risk
 - Environment
 - Have derived environmental impacts from speed profiles
 - Security
 - Requires creative surrogates such as reporting frequency, response time, etc.

Subjective Performance Measures

- Can reveal actions / behaviors
 - Stated Preferences (hypothetical)
 - Revealed Preferences (actual)
- Can reveal opinions
 - Perceptions
 - Feelings
- Must be carefully applied
 - Consideration of key factors
 - Identification of core demographics
 - Pre-testing of survey methods
 - Consideration of statistical validity

Choosing your Measures -1/2

- Choose carefully!
- Contradictory results have been obtained from Advanced Traveller Information Systems (ATIS) evaluation:
 - Survey research consistently finds that ATIS users *perceive travel time savings*
 - BUT, controlled field tests consistently find *marginal to no reduction in observed in-vehicle travel time*
- *Why was this?*

Choosing your Measures - 2/2

- ATIS users ***correctly perceive*** that they save time
- Field studies ***correctly measured*** only small changes in in-vehicle travel times
- When travel behaviour correctly focused on ***travel time reliability***
 - ATIS users save time in terms of *total travel budget*
 - In-vehicle travel time not always minimized

Major Issues in Performance Measurement - 1/3

- Cost of data collection
- Assuring appropriate comparisons to other operations
- Data quality
- Data completeness
- Extrapolating from partial coverage

Major Issues in Performance Measurement - 2/3

- Matching measures to their purposes
- Understanding extraneous influences in the data (choice of control data/site)
- Conflicts with other measuring programs – which is “right”
- Timeliness of data for measures
- Use of measures in allocation of funding

Major Issues in Performance Measurement - 3/3

- Liability for action (or lack thereof) based on measurement results
- Responsibility for measures for which there may be limited control
- Benchmarking and targets
- External factors
- Good multimodal measures

Evaluation Measures: UK TMC Service Evaluation - 1/3



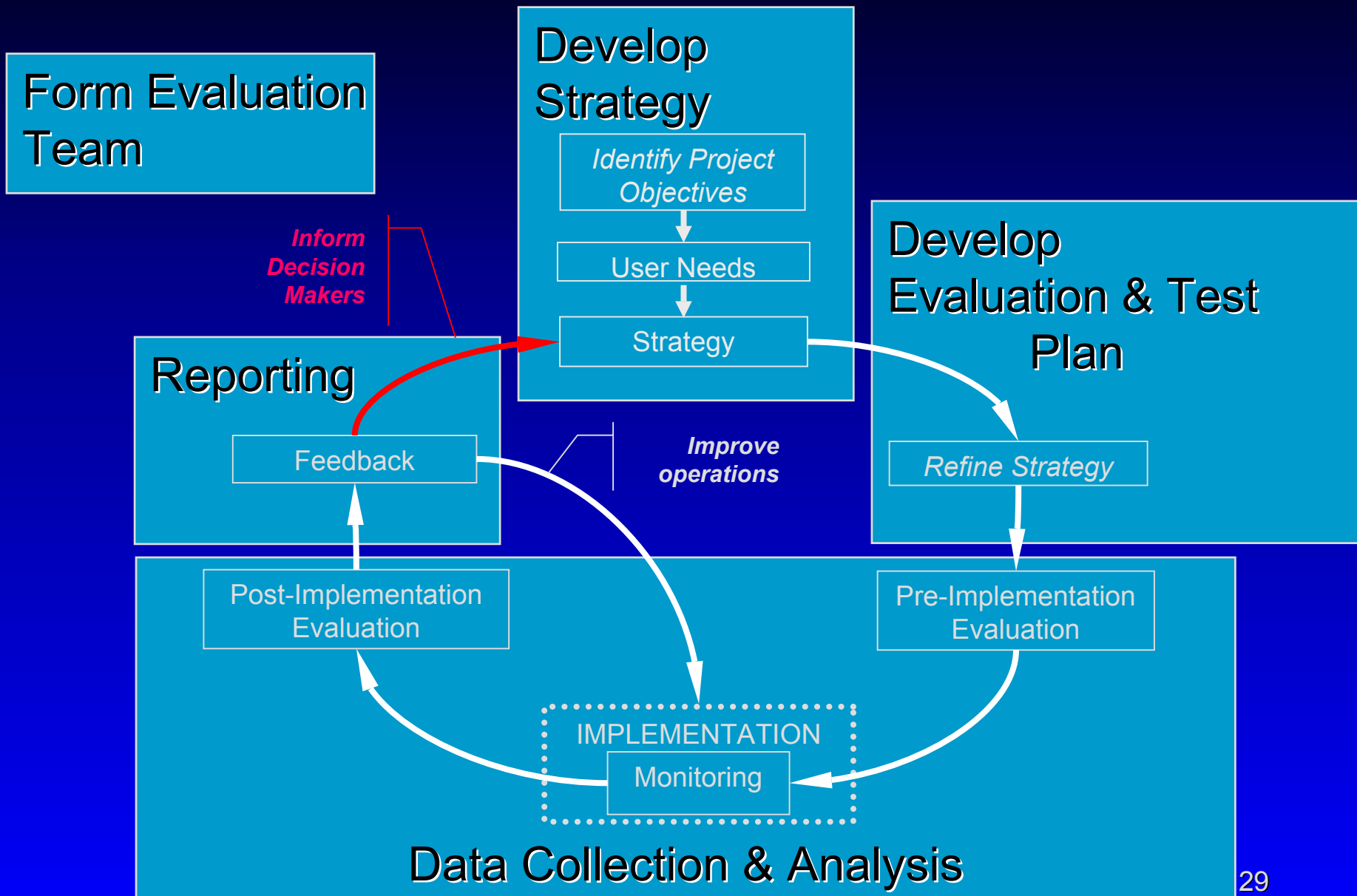
Evaluation Measures: UK TMC Service Evaluation - 2/3

- **Objectives:**
 - **Technical Performance**
 - the distribution of Event Message Types broadcast
 - the accuracy of the information presented
 - the completeness of the message for each provider (AA and RAC)

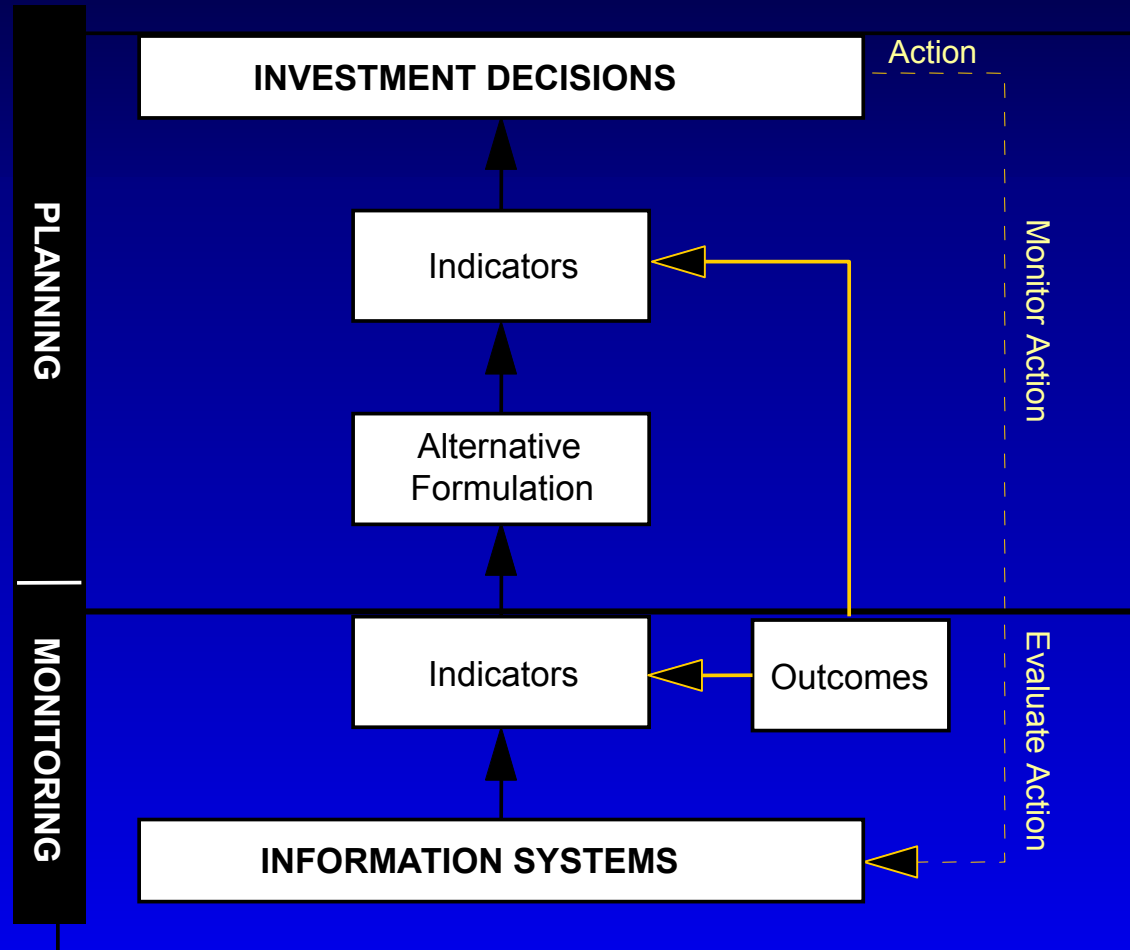
Evaluation Measures: UK TMC Service Evaluation - 3/3

- **Objectives:**
 - **User Acceptance**
 - driver reaction to messages about cleared problems
 - driver reaction to not receiving messages about problems they encounter
 - willingness to subscribe and pay for the service
 - **Impact on the Network**
 - changes in route after receiving a TMC message

Applying Performance Measures



Applying Performance Measures



Getting Results

**System
Performance
Results
(Outcomes)**

**Meeting the
Economy
Objective**

**Measured
by...**



**Performance
Indicators**

- Journey time
- Journey time variability

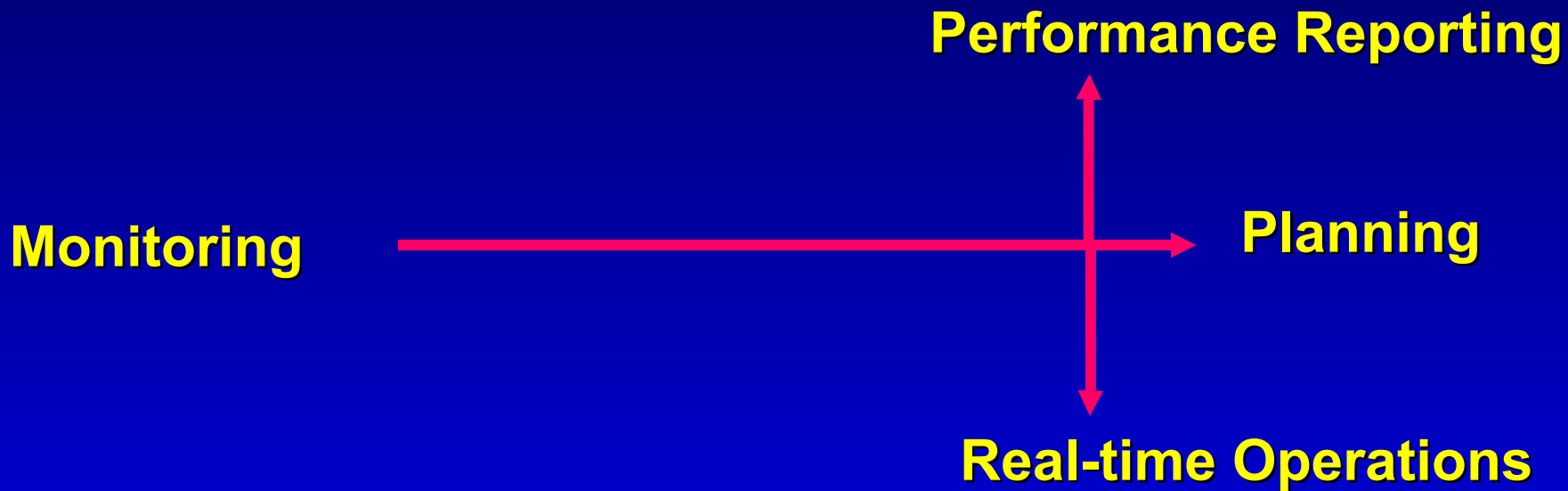
**Calculated
Using...**



**Transportation
Outputs
(Data Sources)**

- Journey times
- Flows
- Average speeds
- Speed variations
- Average vehicle occupancy
- Average trip length
- Incidents
- Accidents

Performance Monitoring Applications



Agenda

- Introductions and Overview
- Background – US perspective
- Background – European perspective
- The Evaluation Process
- Evaluation Techniques & Performance Measures
- **Real Evaluations**
- Wrap-up and Conclusions