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Leading Indicators and Lagging Indicators

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A Black Swan



Black Swan Event

- The event is a surprise (to the observer)
- The event has a major effect
- After the first recorded instance of the event, it is rationalized by hindsight, as if it *could* have been expected; that is, the relevant data were available but unaccounted for in risk mitigation programs

Lagging Indicator

- As defined by About.com, a **Lagging Indicator** is a measure that only changes after the economy has changed
- It is of little use in looking ahead
- However, **Lagging Indicators** are helpful in confirming a trend



Lagging Indicator

- A **Lagging Indicator** is a statistic that follows an economic event
- As such, it can be used to confirm what has happened in the economy, which can then be used to establish a trend
- That makes it particularly useful to identify turning points in the business cycle

Lagging Indicator

- **Average Duration of Unemployment** - The number of weeks those counted as unemployed by the Bureau of Labor Statistics have been looking for a job.
 - During a recession, the number long-term unemployed will increase. Weight = 0.0361
- **Inventories to Sales Ratio** - The Bureau of Economic Analysis calculates this for manufacturing, wholesale, and retail companies.
 - During a recession, inventories rise as sales decline. Weight = 0.1211

Lagging Indicator

- **Change in Labor Cost per unit of Manufacturing Output** - This number increases when factories produce far less per employee, due to slower orders.
 - The only way to reduce this number is to lay off workers, or produce more. Weight = 0.0587
- **Average Prime Rate** - When times are good, banks resist lowering rates (and their profits) even if business starts to slow.
 - When times are bad, they resist raising rates until they are sure the demand supports it. Weight = 0.2815

Lagging Indicator

- **Consumer Price Index for Services** - This is a part of the Consumer Price Index.
 - Service providers may raise prices in the beginning of a recession to maintain profit margins as demand starts to fall.
- Once the recession truly hits, they realize they've got to find a way to cut costs and lower prices.
 - They may keep cutting prices, even once the recovery has begun.
- Those that are left after a recession are likely to continue lowering prices, trying to gain more business because it worked recognizing when the recession is over. Weight = 0.1955

Leading Indicators

- **Leading Economic Indicators** are those that change before economies show any signs of change
- In particular, they provide signs of an upturn or downturn in gross domestic product (GDP) or other **Lagging Indicators** that may be considered of importance
- Initial unemployment claims can be a leading indicator for the unemployment rate

Leading Indicators

- Unemployment Claims
- Building Permits
- Inventory Changes
- Stock Prices
- Inventory Changes

Economic Indicators

- Economic indicators are broadly classified based on their timing, ranging from **Leading Indicators** to **Lagging Indicators**
- **Leading Economic Indicators** are those that change before economies show any signs of change
- **Leading Indicators** are used by investors to help predict the direction of economies and important **Lagging Indicators** for use in making investment decisions

Definition: Lagging Indicator

- A **Lagging Indicator** is a measure that only changes after the economy has changed
- It is of little use in looking ahead
- However, they are helpful in confirming a trend

Relationships

- The Dow Jones Transportation Average is a useful **Lagging Indicator** because it tracks the stock performance of companies that ship our nation's durable goods
- Once manufacturers fill the durable goods orders, they have to ship to customers

Relationships

- There's a lag between the order and the shipments
- If the Transportation Index rises, it means customers haven't cancelled their orders, confirming the movements of the Durable Goods Orders Report, a **Leading Economic Indicator**

Leading Indicator

Definition:

- An indicator that predicts future events and tends to change ahead of that event**
- Sometimes used as a predictor**

Lagging Indicator

Definition:

–An indicator that follows an event

Relationships

- Infections (**lagging**) caused by hand washing rate (**leading**)
- Unemployment rate (**lagging**) indicates that the economy has been doing poorly

Leading or Lagging?



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Leading Indicators

- Leading health indicators:
 - Physical activity
 - Weight
 - Tobacco use
 - Substance abuse
 - Mental health
 - Immunizations, etc.

Leading Indicator

- Dollar gets stronger



Leading Indicator

- Gold goes the other way in value



“What’s the difference between a Leading and a Lagging indicator?”

Leading vs Lagging Indicator

- **Lagging Indicators** without **Leading Indicators** tell you nothing about how the outcomes will be achieved, nor can you have any early warnings about being on track to achieve your strategic goals

Leading vs Lagging Indicator

- Blood pressure is a **Leading Indicator**
- Is it below normal, normal, pre-hypertension, hypertension or worse?
- Blood pressure represents one aspect of an individual's health
- Blood pressure is also what is referred to as a performance indicator

Leading vs Lagging Indicator

- Problems with blood pressure can mean that you either have or have not had a
 - heart attack,
 - stroke or
 - liver failure,
- These events are all potential conclusions to high blood pressure (results) and thus are **Lagging Indicators**

Leading vs Lagging Indicator

- Similarly, **Leading Indicators** without **Lagging Indicators** may enable you to focus on short-term performance, but you will not be able to confirm that broader organizational outcomes have been achieved

Leading vs Lagging Indicator

- **Leading Indicators** should enable you to take proactive actions to improve your chances of achieving strategic goals

Activity vs. Outcome

- If you are measuring “activity” (i.e. at a process level), it is more likely that you are using **Leading Indicators**
- The closer you move to process inputs and activities, the closer you get to **Leading Indicators** of downstream, (**Lagging**) performance
- If you are measuring aggregated effects, or outcomes, at an organizational level, you are more likely to be using **Lagging Indicators**

Leading Indicators

- Pertinent measurable activities are selected for observation
- Statistical trends are recorded and analyzed
- Predictions are made of future performance before the performance changes occur
- Forecasts may not be accurate

What?

Selection of leading indicators is largely judgmental and only time will tell whether the indicators selected are the right ones

What Do We Know About Tomorrow?

- In a major construction project, the management team used **Leading Indicators**, and for which the progression for incident experience was commendable
- Toolbox safety talks at the beginning of each shift; good housekeeping; barricade performance for elevated areas; and management walking around to show leadership and commitment

What Do We Know About Tomorrow?

- “One can debate how much of this improvement is directly linked to use of **Leading Indicators**”
- “The management team and workers had a desire to improve and likely would have shown improvement without the process.”

What Do We Know About Tomorrow?

- Definitions of **Lagging Indicators** in the economics field say they are measures of changes that occur “only after the economy has changed”
- It implies that **Lagging Indicators** trail and are moved by earlier economic changes

What to Measure ?

- Traditional Injury Indicators
 - Total Number of Injuries & Illnesses
 - Workers Compensation costs
 - Lost time injuries
 - Injuries sort by body part, type, nature of injury
- These “**Lagging Indicator Measures**” are a ‘rearview mirror’ view

Lagging Indicators

- “After the Fact”, person is already injured or ... dead
- Focuses management on the wrong data
- What have you proactively done for prevention ?
- No insight on working safely, “injury drivers” not identified

Lagging Indicators

- Not precise, data manipulation, no insight on preventative actions
- Injuries are never eliminated
- Fact: **“Leading indicators”** drive **“Lagging Indicator Results”**

What to Measure ?

- In safety-critical systems, the use of **Leading Indicators** has been proposed to identify areas of weakness in advance of adverse events, affording the possibility of taking action to avoid losses
- This is in contrast to **Lagging Indicators**, such as numbers of accidents or incidents, which give indications of past performance

What to Measure ?

- The Chernobyl report identified the absence of a safety culture as the major contributor to the disaster, and defined safety culture as
- “That assembly of characteristics and attitudes in organizations and individuals which establishes that, as an overriding priority, [nuclear plant] safety issues receive the attention warranted by their significance”

What to Measure ?

- Subsequent reports into other major disasters produced similar findings
- They too recognized the impact of safety culture on the outcome of safety performance, noting that most operational incidents are not solely the result of human error, technical failures, or environmental factors

What to Measure ?

- Often there are more systemic organizational or managerial flaws
 - a fatal combination of failure of management
 - employees not performing their duties
 - a breakdown in documented systems

What to Measure ?

- Inspection: is comprised of any number of observations
- Observation: a specific condition or behavior that is noted by an inspector
- **Lagging Indicator:** measures an organization's incidents in the form of past accident statistics

Leading Indicator: What to Measure ?

- **Leading Indicator:** a measure preceding or indicating a future event used to drive and measure activities carried out to prevent and control injury

Leading Indicator: What to Measure ?

- # of inspections/ assessments/ observations
- # of inspections/ assessments completed
- Face time in the field versus planned # of safety contacts
- Safety meetings, training conducted (and vs. planned)

Leading Indicator: What to Measure ?

- Implementation of action plans resulting from audit findings
- Percentage of incidents investigated
- # near misses reported
- Percentage of JSA's completed for critical activities
- Percentage of corrective actions remediated

Keys to Good Measurement?

- Developed with input from stakeholders
- Well communicated
- Supported by management
- Focused on progress more than activities
- Focused on visible results / output
(Objective rather than Subjective)

Effective Metrics Are ...

- Reasonable goals / objectives
- Compared against something (standard)
- Measured regularly
- Not changed often
- Realistic and Attainable

Effective Metrics Are ...

- Driven by data
- Reported publicly
- Measured at line management / supervisor
- Part of performance process

Failure Points For Using Metrics

- Metrics are Not Measurable / Quantifiable
- No relationship between data and plans
- Subjective measurements
- They are a secret / not communicated
- Not Attainable

How Do We Measure?

- Tabulate results of activities (freq.)
- Measure percent accomplishment
- Measure progress on objectives / goals
- Compare results to plans and schedules
- Compare against goals or objectives

What are Leading Indicators?

- Also known as activities indicators, upstream indicators
- Before-the-fact indicators
- Do not reach the threshold of causality to create an incident
- Measure safety-relevant activity, not safety per se

What are Leading Indicators?

- Measure inputs
- Measure precursors to harm
- Can be used as predictors of future performance and changes can be made to improve probability of good performance

Leading Indicators

- **“Leading indicators ... are conditions, events or measures that precede an undesirable event and that have some value in predicting the arrival of the event, whether it is an accident, incident, near miss or undesirable safety state”**

Leading Indicators

- **Leading indicators** are associated with proactive activities that identify hazards and assess, eliminate, minimize and control risk”
- “Something that provides information that helps the user respond to changing circumstances and take actions to achieve desired outcomes or avoid unwanted outcomes”

Leading Indicators

- Signal that a condition has been met that may directly, and/or in the presence or absence of other conditions, result in an undesired outcome, with or without a degree of time delay

Lagging Indicators

- Also known as
 - Outcome indicators,
 - Trailing, down-stream and
 - After-the-fact indicators

Lagging Indicators

- Measure the extent of harm that has occurred – past performance. Reactive, tells you whether you have achieved a desired result (or when a desired safety result has failed) and provide historical information about health and safety
- Measure unexpected failures occurring in normal operations

LaggingIndicators

- Identification of a **Leading Indicator** that has moved outside of its acceptable parameters has to prompt appropriate actions as part of the process of monitoring, feedback and control
- In other words, organizations should implement preventative actions related to **Leading Indicators**

LaggingIndicators

- **Leading Indicators** contribute to an organization's ability to develop appropriate proactive action strategies to prevent harm, through recognizing early signals, with allied safety, health, financial and other business benefits

Lagging to Leading Indicators

- The shift towards **Leading Indicators** has been driven in part by the increased awareness that organizational and human factors rather than purely physical or technical failures are prime causes of OHS incidents

Lagging Indicators

- Good OHS indicators (**Leading** and **Lagging**) should be reliable, repeatable, consistent and independent
- Linearity and ease of use are beneficial but not necessary characteristics

Lagging & Leading Indicators

- Allow accurate and detailed comparisons lead to correct or help avoid erroneous conclusions
- Be well understood by everyone, especially those responsible for implementing change
- Have a quantitative basis (even when measuring a qualitative dimension)

Lagging & Leading Indicators

- Measure what they are supposed to, consistently, accurately and reliably
- Collect information that is relevant to the required management decisions and actions
- Adequately map and identify causal linkages (root causes, precursors, events and outcomes)

Leading Indicators

- **Lagging indicators** measure final outcomes – they are tools that identify the hazard once it has manifest
- Thus, the cause of the incident and its effects can be identified, but only after the incident and (potential) injury has occurred

Leading Indicators

- **Lagging Indicators** have been the focus of attention not least due to the ease of data collection and measurement, as well as having been driven by regulatory reporting requirements

Leading Indicators

- Are actionable, predictive and relevant to objectives
- Identify hazards before the fact
- Allow preventative actions before the hazard manifests as an incident
- Allow response to changing circumstances through implementing
- Control measures before the incident

Leading Indicators

- Measure effectiveness of control systems
- Measure inputs and conditions
- Direct towards an outcome that we want or away from an outcome that we don't want
- Give indications of systems conditions
- Measure what might go wrong and why
- Provide proactive monitoring of desired state

Leading Indicators

- Are useful for internal tracking of performance
- Identify weaknesses through risk control system
- Are challenging to identify and measure
- Evolve as organizational needs change

Lagging Indicators

- Are retrospective
- Identify hazards after the fact
- Require corrective actions to prevent another similar incident
- Indicate that circumstances have changed; control measures can be implemented after the incident
- Measure failures of control systems

Lagging Indicators

- Measure outcomes
- Measure the current outcome without influencing it
- Measure system failures
- Measure what has gone wrong
- Provide reactive monitoring of undesired effects

Lagging Indicators

- Are useful for external benchmarking
- Identify weaknesses through incidents
- Are easy to identify and measure
- Are static
- simple to understand and demonstrate objectively how they are making a difference

Lagging Indicators

- Cost efficient in terms of the equipment, personnel and additional technology required to gather the information
- Educational, create positive energy, drive continual improvement and sustainability and cost reduction
- Able to fit in with other strategic measures of the organization

Lagging Indicators

- A simple example of a generic health leading indicator would be obesity
- Being obese (a root cause) can lead to potential problems such as heart failure, the development of diabetes, vascular problems and joint degeneration (undesired outcomes)
- Knowing that obesity can have these consequences allows early action

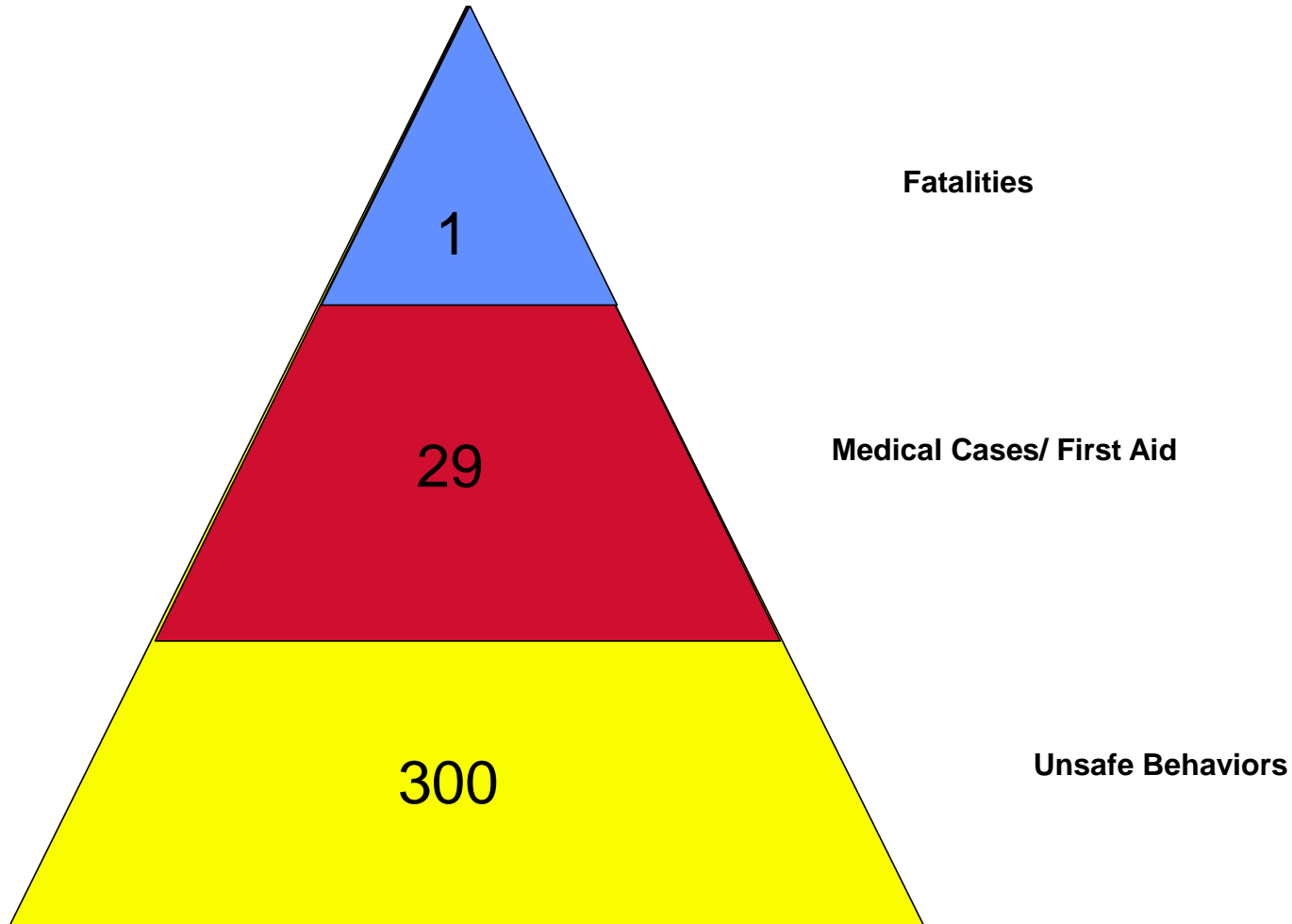
Leading Indicators

- Therefore, measuring a more specific **Leading Indicator**, such as calorific intake or levels of exercise, can help reduce the risk of obesity
- If obesity is already a factor, implementing a weight loss program through improved diet and increased exercise (the action strategy) would reduce the risk that any of these longer-term problems might occur

Leading or Lagging?



What to Measure ?



Questions



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