Week 1: Evaluate Cybersecurity

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# Compare Research Methods

Quality research begins with a well-defined set of questions, such as ‘can an autonomous vehicle safely navigate city streets?’ Next, the researcher needs a plan to answer the question by collecting evidence and observations.

## Selecting Research Methods

Executing that plan requires a collection of quantitive and qualitative methods. Each of these methods is a tool that comes with its inherent strengths and weaknesses (Jason & Glenwick, 2016). These attributes necessitate researchers to understand when a hammer is more appropriate than a screwdriver (see Table 1). Consider the difference between the vehicle study’s objective is (a) to identify safety requirements versus (b) modeling the limitations of the braking system. Under (a), qualitative methods best support the open exploratory nature of the problem. With (b), the answer needs a quantitative method that describes the relationship of multiple variables, such as the car’s speed and the number of objects on the road. However, a more comprehensive study could answer both (a) and (b) by first uncovering the importance of braking enhancements, then describing the limitations in greater detail.

Table 1: Research Approaches

|  |  |  |
| --- | --- | --- |
| Approach | Description | Example Use Case |
| Quantative | Statistical modeling of a scenario | * Estimate the probability of an event * Stating a broad generalization * Cause and effect analysis |
| Qualitative | Non-numerial representation of a scenario | * Open-ended surveys * Exploration of needs * Investigating a local issue |
| Mixed | Combination of both quantitative and qualitative | * Examining the breadth and depth of a topic * Examining a scientific idea then mapping it to use cases |

## Influence of World Views

While performing these various methods, researchers need to be cognizant of their biases and worldviews (Creswell, 2014). These perspectives (see Table 2) influence data interpretation and can result in radically different conclusions.

Table 2: World Perspectives (Creswell, 2014)

|  |  |
| --- | --- |
| View | Perspective |
| Postpositivims | Theory verification |
| Constructivism | Theory generation |
| Transformative | Change-oriented |
| Pragmatism | Reality-centric |

For instance, the Washington Post (2020) maintains a record of every victim of police violence. When Pierce (2019) studied this dataset, he found statistical evidence that confirmed his view of systematic racism. Later, Harald Uhlig, an economist professor at the University of Chicago, used the same public dataset to conclude the opposite (Derby, 2020). Despite using the same quantitative approach with the same data, these two professionals came to radically different results due to being transformative versus pragmatic. This challenge arises because statistics describe a specific context (Denis, 2015). Since both researchers could select a context that aligns with their narrative, Pierce examines the victims’ raw ratios versus the national population. In contrast, Uhlig uses demographically adjusted values based on the individual state’s populations (e.g., California or Texas).

## Enhancing with Qualitative Methods

Instead of relying solely on quantitative methods, these researchers could incorporate qualitative information to avoid solving the wrong problem (type III error) (Crabtree & Miller, 1999). From examining the fatality context upfront, both parties might have realized that the victim is armed is more influential than demographics. With nearly 75% of all incidents involve the suspect having a gun or knife—the better question asks, ‘how can society address this safety issue?’ However, that point does not fit into either researcher’s motive of demanding social change or discrediting reform efforts.

# Comparing Use-Cases within Risk Management

Choosing the right reacher method is critical for all publications, even areas outside of sociology. Consider the variability of approaches that can effectively co-exist across a broad topic like risk management.

## Using Qualitative Methods

Many significant problems, such as aspects of risk management, are not generalizable and contain fuzzy rules. Today, businesses are unable to address every risk due to having finite resources. Instead, prioritization of governance and risk mitigation policies must occur in a personalized manner. In “A conceptual framework for integrating information privacy protection,” Abdullah et al. (2016) approach this issue by providing a hierarchical framework for positioning different aspects of the problem. They acknowledge that it does not make sense to directly compare one branch’s value over another due to organizations having different requirements. Alternatively, through a series of open-ended questions, the authors guide the reader to the correct choice.

## Using Quantitative Methods

Other risk management qualities are generalizable, such as detection of Distributed Denial of Service (DDoS) attacks. In “New approach to Determining DDoS,” Al-Haidari and Al-Dahasi (2019) feed two traffic metrics into a classification engine. These metrics summarize network protocol metadata (Layer-4) to predict the likelihood the source is legitimate. This use-case is ideal for pure quantitative methods. Under a qualitative approach, the classification engine would have rules that lack a statistical model’s sophistication.

## Using Mixed Methods

One of the challenges with Abdullah et al. (2016) purely qualitative approach is ensuring consistency of prioritization across the organization. Consider the different skills between engineering teams and how that training variability impacts their ability to make informed decisions. In “Risk Management for Information Security,” Kozlov and Noga (2018) also group risks into a hierarchical structure before assigning weights through a statistical model. Their model contains rules for deriving an expected loss under the likelihood that Confidentiality, Integrity, or Availability (CIA) is compromised.

# Conclusions

Traditional opinions of research methods falsely believe that quantative methods are superior (McCusker & Gunaydin, 2015).