Data for Decision Makers: Data Concepts and Applications

Course Handbook

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Preface

In today's data-driven world, the responsibility of public service demands more than experience and intuition; it requires evidence-based decision-making grounded in a deep understanding of data. For government officials at all levels, from local administrators to national policymakers, data is not just a tool - it is an indispensable asset in crafting policies that are effective, equitable, and accountable. Data for Decision Makers is developed with you in mind: to support those entrusted with public leadership in leveraging data to serve communities more effectively.

Across the domains of public health, education, transportation, environmental policy, and beyond, the availability of data has never been greater. But with this abundance comes complexity. Making sense of it - identifying relevant patterns, understanding root causes, evaluating outcomes, and anticipating future trends - requires more than access. It demands a strong foundation in the principles and practices of modern data use.

This course highlights how data literacy empowers government officials to navigate uncertainty, combat misinformation, and design policies that truly respond to the needs of the public. From statistical reasoning and geographic information systems to predictive modelling and real-time dashboards, the tools of data are transforming governance. Understanding these tools is essential to strengthening transparency, accountability, and public trust.

This course bridges the gap between technical expertise and policy leadership. It offers clear, accessible explanations of core data concepts alongside practical examples from the public sector. Whether your role involves strategic planning, budget allocation, programme evaluation, or legislative development, this course will help you make more informed, timely, and impactful decisions.

Public service is a profound responsibility. By embracing the potential of data, government leaders can enhance their ability to meet that responsibility with clarity, foresight, and integrity.

1 Introduction

In an era defined by information, the ability to make sound decisions increasingly hinges on the intelligent use of data. Across sectors and industries, from healthcare and education to finance and public policy, decision-makers are confronted with unprecedented volumes of information. Yet, it is not the sheer quantity of data that holds value, but our capacity to interpret, understand, and apply it effectively.

Data is more than numbers on a spreadsheet; it is the language of modern insight. When approached with the right tools and understanding, it becomes a powerful asset for identifying patterns, predicting outcomes, evaluating strategies, and ultimately, improving results. For decision-makers, this means developing fluency not just in reading reports, but in questioning assumptions, validating sources, and interpreting results within context.

Understanding modern data concepts - from statistical reasoning and data visualisation to machine learning and real-time analytics - is no longer optional. It is foundational. These concepts empower leaders to move beyond intuition and anecdote, and toward evidence-based action. As data continues to shape the world around us, the ability to engage with it critically and creatively is becoming an essential skill.

This course aims to equip its participants with both the conceptual grounding and practical knowledge to navigate this landscape. Whether you are a seasoned executive, a policy analyst, or an emerging leader, this course is designed to bridge the gap between data science and decision-making. It demystifies the tools and techniques of modern data analysis and offers real-world applications that demonstrate how data can drive progress and innovation.

Good decisions are not just supported by data; they are shaped by those who know how to use it wisely.

1.1 Data-driven decision-making

Data-driven decision-making or DDDM refers to the process of making decisions based on data and information rather than intuition or experience alone. It involves collecting, analysing, interpreting, and presenting data to support decision-making processes[1–3].

In this approach, decisions are made by relying on facts, figures, trends patterns, and insights derived from data. The goal is to make objective, evidence-based decisions that are more accurate, consistent, and transparent.

Note 1: Features of data-driven decision-making

Data-driven decision-making is widely used in various fields such as business, healthcare, finance, education, and government. It allows organisations and individuals to:

1. **Informed Decisions** - make decisions based on data rather than assumptions or guesswork;
2. **Improved Accuracy** - educe errors and biases by relying on objective information;
3. **Efficiency** - Optimise resources and processes by identifying trends, patterns, and inefficiencies;
4. **Transparency** - ensure that decisions are made in an open and transparent manner; and,
5. **Scalability** - Apply to large-scale operations or complex problems where traditional methods may be insufficient.

Data-driven decision-making often involves the use of tools, techniques, and technologies such as data analytics, machine learning, artificial intelligence, and visualisation software. By leveraging these tools, organisations can transform raw data into actionable insights that drive better outcomes.

In today's organisations, this approach has become increasingly important as it allows for more objective and accurate decision-making. The process typically includes identifying relevant data sources, applying analytical techniques, and leveraging technologies like machine learning, artificial intelligence, and visualisation tools to transform raw data to actionable insights that drive better outcomes.

An organisation that is data-driven also benefits in being able to spot opportunities and threats early. By analysing data regularly, organisations can anticipate changes and act before problems arise.

Saving costs is another advantage. In a survey of executives of Fortune 1000 companies regarding their data investments since 2012 commissioned by the Harvard Business Review, nearly half (48.4%) of respondents report that they are documenting measurable results from their investments in big data and 80.7% of the executives describing their investments in big data as being successful[1,4].

1.2 The case for data-driven decision-making

The context described above alongside the potential benefits proffered are strong reasons for considering a shift towards using data more effectively in decision-making processes. The following case studies provide a more nuanced narrative of opportunities and challenges of

adopting a data-driven approach to decision-making specifically in the context of governance within governments (rather than just in businesses).

1.2.1 Data use and analytics in water quality management

This is a case study about a United States state agency struggling with DDDM in addressing environmental issues like harmful algal blooms (HABs) and high chloride concentrations[3].

In addressing the challenges faced by an organisation in implementing DDDM, it is crucial to consider a comprehensive strategy that encompasses nine key determinants (see Note 2). These factors interrelate and influence each other, requiring a holistic approach to ensure successful adoption.

> **i** Note 2: Nine key determinants for an effective DDDM strategy
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> 1. **Data Infrastructure** Ensuring robust data infrastructure is foundational, as it supports the collection, storage, and accessibility of data necessary for effective analysis.
> 2. **Analytical Capabilities** Investment in both skilled personnel and advanced tools is essential to transform raw data into actionable insights.
> 3. **Organisational Capacity** Fostering a culture that embraces change and collaboration within the organisation is vital for adaptability and innovation.
> 4. **Institutional Environment** Engaging with external institutions and navigating legal frameworks can provide resources and support, or pose restrictions, respectively.
> 5. **User Involvement** Collaborating with end-users ensures that solutions are practical and aligned with real needs, enhancing decision effectiveness.
> 6. **Stakeholder Engagement** Broad stakeholder involvement brings diverse perspectives, enriching the decision-making process.
> 7. **Public Procurement Rules** Navigating bureaucratic processes efficiently can accelerate tool adoption without unnecessary delays.
> 8. **Privacy and Confidentiality Constraints** Addressing legal requirements regarding data protection is crucial to ensure comprehensive analyses.
> 9. **Innovation and Collaboration** Access to external resources and communities fosters creativity and collaboration, vital for overcoming challenges.

These key determinants are interrelated and interdependent. For example, if an organisation has strong data infrastructure (determinant 1) but lacks the right analytical tools or skilled personnel (determinant 2), their DDDM efforts will be hampered. Similarly, even with good internal structures (determinant 3), if external regulations make it hard to access

necessary tools or collaborate externally (determinants 7 and 9), progress is still limited. Without proper stakeholder engagement (determinant 6) and user involvement (determinant 5), the organisation might develop solutions in isolation, leading to less effective decisions. Moreover, privacy constraints (determinant 8) can affect data availability, which in turn impacts analytical capabilities since data is a key input.

While DDDM is often seen as a technical issue involving tools and data, it's also deeply influenced by organisational and institutional factors. This makes sense because any significant change requires not just new technology but also cultural shifts within the organisation to embrace these changes.

These determinants also influence the ability of an organisation to adapt over time. For example, if the organisation faces challenges in public procurement, which is a structural issue, this could create delays that affect the organisation's overall strategy. Conversely, strong stakeholder engagement might mitigate some of these delays by providing alternative solutions or resources.

1.2.1.1 Leadership role

Leadership plays a critical part in driving organisational change. Without supportive leadership, many of these determinants could be obstacles rather than opportunities. For instance, if leaders aren't committed to DDDM, they might not push for necessary cultural shifts or investment in new tools.

1.2.1.2 Balancing existing practices

The balance between existing practices and new methods is important. While the state agency was implementing DDDM, traditional approaches were still relied upon. This blend can be beneficial initially but may need careful management to avoid conflicts or inefficiencies as newer methods prove their worth.

1.2.1.3 Measuring success

How would this state agency assess its progress in implementing DDDM? They might look at metrics like the quality and timeliness of decisions, reduction in issues (like HABs), efficiency improvements, and user satisfaction. These outcomes can help gauge whether their efforts are paying off despite facing various challenges.

1.2.1.4 Conclusion

A tailored strategy that evaluates specific organisational strengths and weaknesses across these determinants is essential for effective DDDM implementation. This approach ensures that each organisation maximises opportunities while minimising challenges, leading to more informed and efficient decision-making processes.

2 All about data

We'll explore everything from the basics—such as what data is and why it matters—to more advanced topics like data collection, storage, analysis, and visualization. Through practical examples and real-world applications, you'll learn how to harness the power of data to drive insights, solve problems, and make informed decisions in fields ranging from business and technology to healthcare and beyond. By the end of this course, you'll not only understand the importance of data but also be prepared to apply these concepts in your own work or further studies.

3 Data privacy, security, and protection

4 Data tools

5 Data entry system

6 Introduction to data analysis

7 Exploratory data analysis

References

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4. Bean, R. How companies say they're using big data. *Harvard Business Review* (2017).

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