Bayesian Methods in Practice: Data Science Tools for Decision Analysis and Economic Decision Modelling, with applications to Healthcare and Product Management

2025 SDP Conference Virtual Workshop

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Why these topics?

The Society of Decision Professionals (SDP) recognizes that applications of Decision Analysis are changing rapidly, with pressure from Data Science and AI

- ”High-tech” companies are discovering Decision Analysis concepts improve their product decisions
- Probability-based data analysis from machine learning fits nicely with Decision Analysis methods
- Healthcare is an excellent example for analytical decision making.

Our Schedule: What we'll cover

- 8:00 Introductions
- 8:15 Eva, Google product manager shows you how Data Science teams can be empowered to make high-paced product decisions.
- 9:30 John Mark, ex-Microsoft, demonstrates how current machine learning software can be integrated with existing Decision Analysis tools.
- 10:30 Bob and Joseph, also ex-Microsoft, show how Bayesian "MCMC" analysis is applied to analytical decision making.

Please introduce yourselves!

Make Better Decisions With Data

Using decision analysis to grow analytical maturity

SDP Annual Conference 2025

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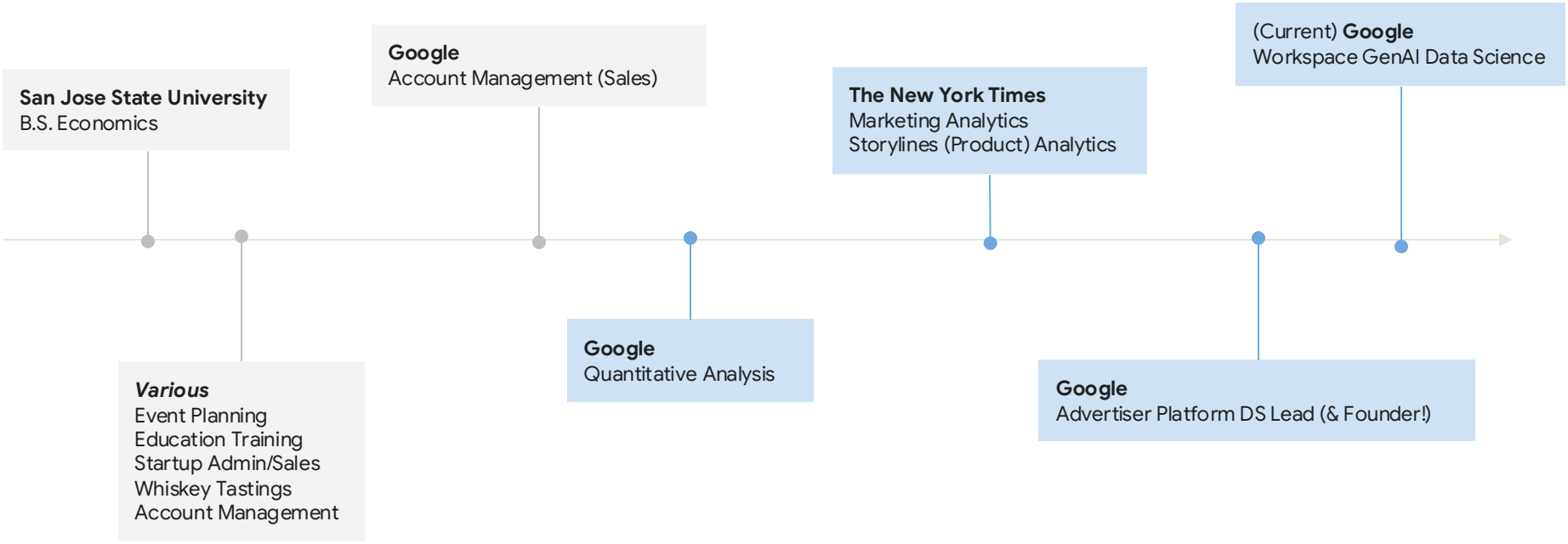
My Path to Data Science



What I've learned: An analysis is valuable if and only if it helps make decisions

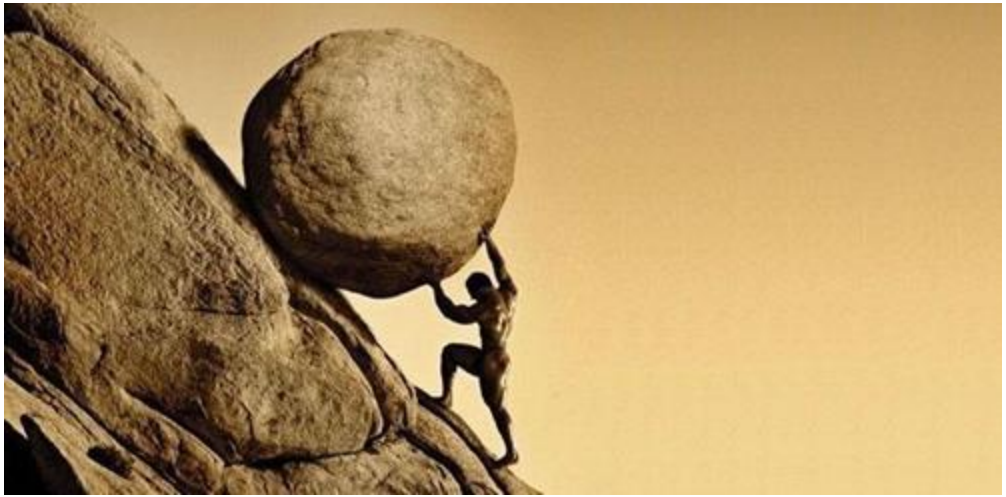
(TLDR) Use Data Science with Decision Analysis to improve Decision Quality

1- Understand the value of having Data Science in an organization is not insights generation, it is: **making better decisions with data**

2- Use decision frameworks to elect the right projects for your Data Science teams that **answer core business questions AND build up analytics capabilities for longer term success**

The Problem: There's so little time but there are infinite questions (often asked last minute)

If you focus on the wrong things, you'll get stuck in a reactive ad-hoc cycle, feeling like you and your team is underutilized and undervalued.



The Dream: High performing, well respected DS teams working on the most impactful projects

What does this look like:

Cool Impactful Projects: your team works on valuable projects that clearly influence decisions, strategy and direction of your partners

Happy Data Scientists: Data Scientists feel fulfilled and proud of their work

Seat at the Table: Partnering with Data Science is a no-brainer; we help our partners come to better decisions using data

More control over you and your team's destiny ~~

Why do teams bring in Data Science?

Data Science informs the product development lifecycle

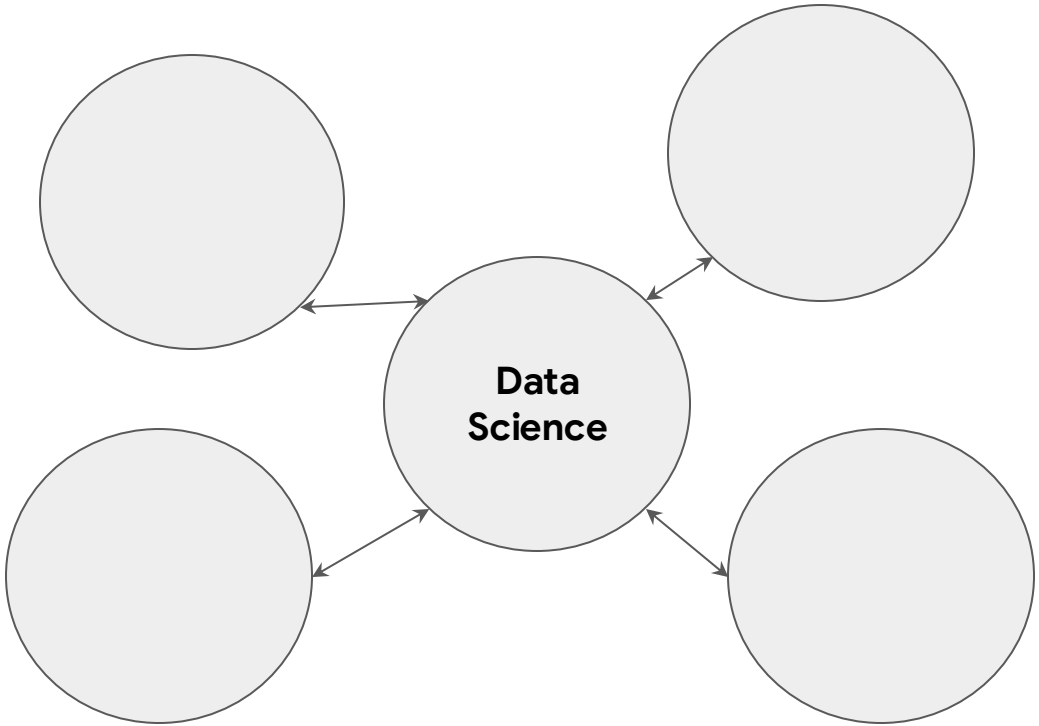
Strategy & Discovery	Planning	Testing & Development	Evaluation
●Proactive insights ●Health Reporting	●Metrics Development ●Opportunity Sizing	●Experimentation analysis ●Causal Inference	●Dashboarding/Reporting ●Deep dives
What should the business focus on? What are our gaps/areas of opportunity?	*How will we know we are successful? What can we expect?*	*Should we launch X product or feature?*	*How is our business doing? What resonates with what cohorts of users?*

Data Science teams invest in foundational capabilities to scale ability to answer core business questions

Data Capabilities

●Data production infrastructure (i.e. logs processing)
●Data warehousing & ownership (i.e. storage, governance)
●Metrics development & maintenance
●Reporting pipelines and dashboards, staples metrics
●Experimentation platform & standards
●User analysis and segmentation

Think of your team as a hub and spoke model. You are responsible for DS success & understanding the value the team brings (and what projects you work on!)



There's so much you could do, how do you choose? Identify important projects that help short & long term organizational decision quality

Your team's portfolio should include at least one thing from each category:

Business Decisions

Pick projects that align with your partner teams goals and only where your work will help the team make a decision.

Analytical Maturity

Identify ONE area to invest in increasing the overall maturity. Secure sponsorship from a decision maker.

DS Practice

Build up your teams norms and rituals to ensure your team is becoming more high performing.

Working Models

Strengthen your relationships with your stakeholders by understanding their value functions.

Where possible: learn/steal from others!

Business Decisions: Understand business goals, source projects & identify their value, then rank!

Project	Description	Objective/Goal	Decision (Value of information)	Who's asking?	Stack Rank
Project name/identifier	*Brief description of the project, including what the deliverable will be (i.e. a model, an analysis*	*If a project will not support a business objective, it's probably not worth doing at this time.*	*Identify what decision will be made from this analysis.*	*Who's the key stakeholder?*	*Fill this in after identifying all projects*

Business Decisions: Does your information have value? Only choose projects that lead to decisions related to top goals. Say No to everything else.

Is this data is really needed from Data Science?

- "If this number goes up, is that bad/good? What will you do differently?"
- "Can you make this decision without the data?"

Is this data going to be used for the most important projects?

- "I'd love to work on this! However I'm working on X project that is tied to Y goal, if you think this is more important..."
- "We are strapped for bandwidth right now! However, we'll add it to our backlog!"

Is there a difference in opinion on values/tradeoffs?

- "Ah, I can see how this is an important project, my priorities right now are X, however, if you can convince/escalate to my boss.."

Analytical Maturity: Use a maturity framework to understand your organization's capabilities. Carve out time for this work by getting decision maker sponsorship

- For each category, identify:
  - Level 1: Reactive, manual
  - Level 2: Split reactive/proactive, manual
  - Level 3: Proactive, manual
  - Level 4: Proactive, automated
- Ask Decision Maker what's the most painful for them
- Choose **ONLY ONE** area that you're going to focus on and bring up by at least one point of maturity

Analytical Maturity: Audit

	Area 1
Data Production & Infrastructure	
1 - Significant issues exist with logs processing, pipeline maintenance, and/or data retention	
2 - Improvements have been made but data is still frequently unreliable	
3 - Additional improvements and issues are more rare	
4 - Nearly zero data production or execution issues	
Data Warehousing & Ownership	
1 - Data Warehousing efforts are manual/built and error-prone	
2 - Scaling issues, data ownership may be unclear	
3 - Central data warehousing, some pain points still evident	
4 - Data Warehousing is managed centrally and there is clear data ownership. Data access is tool-based and seamless	
Metrics & Dashboards	
1 - Unreliable workflows and failing pipelines abound; shifting metrics	
2 - Basic North Star metrics and metrics are in semi-stable dashboards	
3 - The org is empowered to self-service data questions through dashboards, intuitive tools, and easy-to-query tables	
4 - Fully config-driven analytics with simple UIs	
Experimentation	
1 - Experiment infrastructure is lacking or non-existent	
2 - Analysts own experimentation and struggle with scaling	
3 - Robust documentation exists and experimentation is self-service, but it's still manual with pain points	
4 - Automated end-to-end experimentation including UI-based configuration/validation and automated analysis	
Understand Users	
1 - Analysts have limited bandwidth for proactivity / feel like a support role	
2 - Analysts have some bandwidth for proactive work	
3 - Analysts spend ~half of their time on proactive analytics	
4 - Analysts spend nearly all their time understanding users to drive product change and are equal partners influencing the most critical problems across the org	

- Per category, define what each level of maturity means
- For any major partner area you support, identify where you fall per category
- Across the business, you'll start to see themes

Analytical Maturity Example: Ads Platform Metrics

Why Metrics?

- We identified rigor in setting metrics as one (of many) underdeveloped areas
- Our product manager leads care about this (major pain point, easy to get sponsorship)

What are we doing?

What are we not doing?

- No improvements in anything else: We're keeping experimentation, data warehousing, data eng, analytical report standards exactly the same maturity.

DS Practice: If you're going to climb the curve & become a more strategic function, you need to be thoughtful about your practices.

- Identify values & **pain points** using a Retrospective
- Keep a running list of potential projects but pick only a couple to start with
  - Consider value & trade-offs "If we don't do this what's at stake"
- Have members of the team own delivery where it makes sense (encourages team stewardship)

Note: Process/Norms are only useful and will only have sticking power if they address an actual need. Things function without them. They are extremely annoying overhead if they aren't implemented carefully. You'll probably get it wrong the first time. Iterate.

DS Practice: How to run a retro

- Start / Stop / Continue
- Give team 5-8 minutes to brainstorm items for each section individually.
  - “We should start/stop/continue..”
- Allow team to contribute their ideas to each section
- Have people vote on items mentioned
- Assign responsibilities

Example projects

- Onboarding docs
- Intake process
- Project management process
- Internal team site / repository
- Code standards & review process
- Mentorship
- Tech Leads
- Analysis review process
- Team rituals (meeting cadences)

Working Models: Think about what people want & don't go at it alone! Scale your analytical coverage by working with partners more effectively.

What do people want from you? Three main questions, many solutions:

What are you working on?

- Yearly strategy
- Quarterly plans / OKRs
- Sprints
- Newsletter
- Backlog
- Monthly reviews

Where can I find your finished work?

- Research / Deliverables
- Dashboards
- Metrics
- Data
- Code base
- Data access

How can I suggest new work for your team?

- Strategy planning
- Urgent requests
- Non-urgent requests
- Office Hours/ FAQs
- "How do I best work with your team" documentation

Each of these is a new product and/or process. Pick one (or more depending on bandwidth) to formalize based on team interest/partner priorities.

Tying it all together: Set your priorities within each key category, intentionally.

Business Decisions | **Analytical Maturity** | **DS Practice** | **Working Models**

My team's operational example

- Yearly strategy : Identify what we'll do in the last 3 categories.
- Quarterly Goals: Identify specific partner projects (business decisions) & progress made in other areas
- Sprints: 2 week sprints to ensure we're making progress!

Focus 1

High priority projects

This reflects our day to day BAU work with partner areas.

We choose only projects that move the needle on partner teams goals.

Focus 2

Metrics

Horizontal initiative to uplevel metrics across AP

We are keeping all other maturity areas at their same level.

Focus 3

High Performance DS

Identify and fill in gaps associated with functional excellence. Current needs: Onboarding, Data access, hosting an offsite!

Focus 4

Partnerships

Improve/formalize partnerships with functional areas

Develop a monthly cadence to present major insights

Update intake process.