How to effectively blend Data Science and Actuarial?

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Executive Summary

SITUATION

Data Science and Actuarial Analysis often need to collaborate to deliver actionable solutions to improve profitability or grow a book of business.

Many data science projects fail or get implemented ineffectively when Actuarial and Data Science departments are not closely aligned to ensure success for a portfolio

RECOMMENDATION

We highlight some key elements for success with examples around pricing models in P&C insurance:

Clarity + Buy-in on	Pay attention to (in addition to modeling)
• Value proposition and roadmap • Project scope and consistency • Stakeholder interaction and decision rule making • Roles and responsibilities	• Data availability • Sophistication of technology around implementation • Hand-offs • Maintenance: monitoring of model/data drift

Agreeing On Data Science Initiative Process

Scope	Data Science	Implementation & After

Scope
- Define purpose & usage case(s)
- **Define Minimum Viable Product (MVP)**
- Define implementation path(s)

- Establish governance structure
- Build Communication protocol
- Understand team & project dynamics

- **Position the work within grand scheme/framework**
- Define data scope
- Build model requirement

Data Science
- Understand actuarial assumptions
- Agree on performance evaluation metrics
- Exploratory data analysis
- Model building
- Model selection/Final fit

- **Develop Hypotheses bank**
- **Explanation provision**
- **Agreement on model validation protocol aiming on real time problem solving**
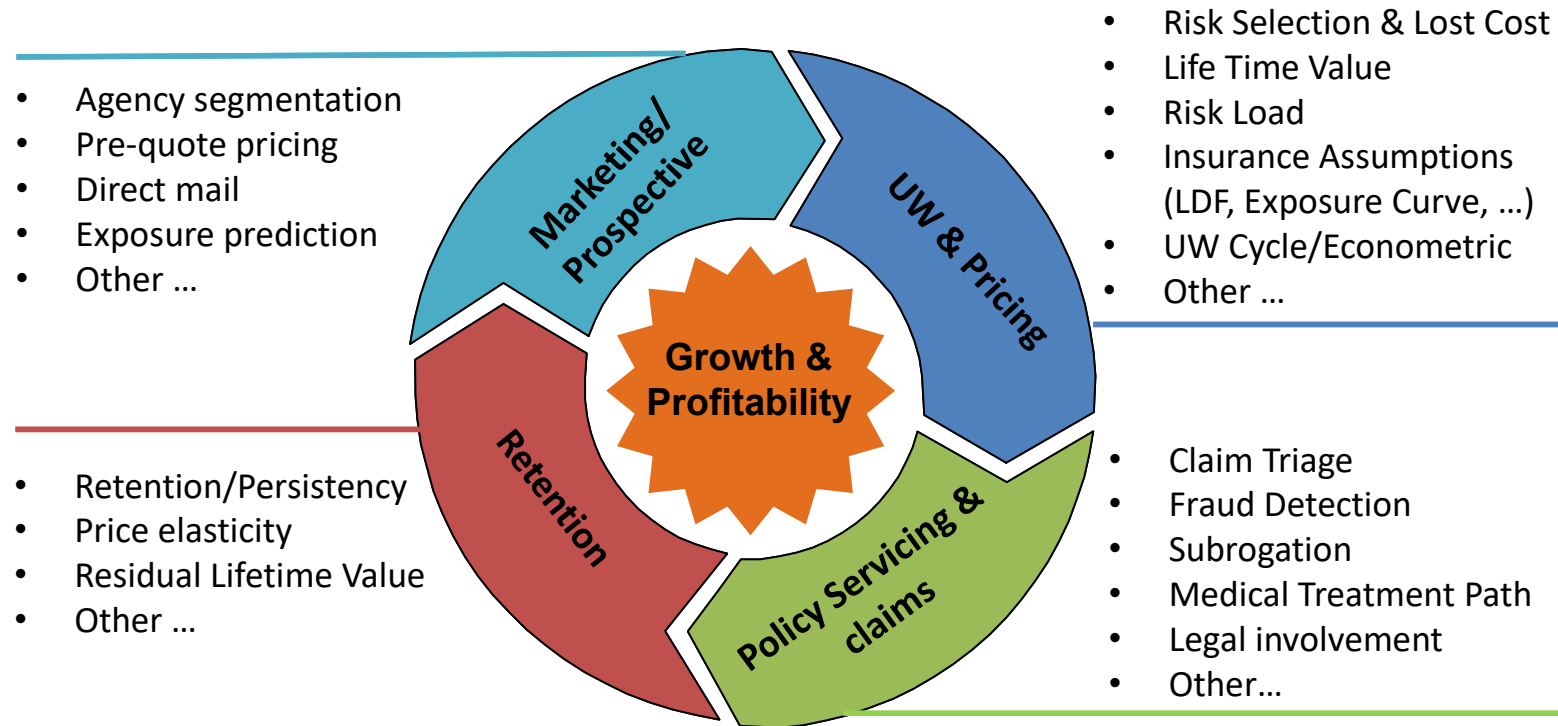
Implementation & After
- Execute implementation strategy: supported by system vs. soft guidance vs. Reference point as R&D Capability
- Documentation/User manual

- Agree on monitoring KPIs
- **Standardize monitoring reports to address issues**
- **Hands-off and Establish capability to perform real-time/on-demand back score**

Iterative Agile Development

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Defining Business Scope and Purpose of an Initiative

Use case within PC Value Creation Chain

Marketing/Prospective
- Agency segmentation
- Pre-quote pricing
- Direct mail
- Exposure prediction
- Other …

UW & Pricing
- Risk Selection & Lost Cost
- Life Time Value
- Risk Load
- Insurance Assumptions (LDF, Exposure Curve, …)
- UW Cycle/Econometric
- Other …

Retention
- Retention/Persistency
- Price elasticity
- Residual Lifetime Value
- Other …

Policy Servicing & claims
- Claim Triage
- Fraud Detection
- Subrogation
- Medical Treatment Path
- Legal involvement
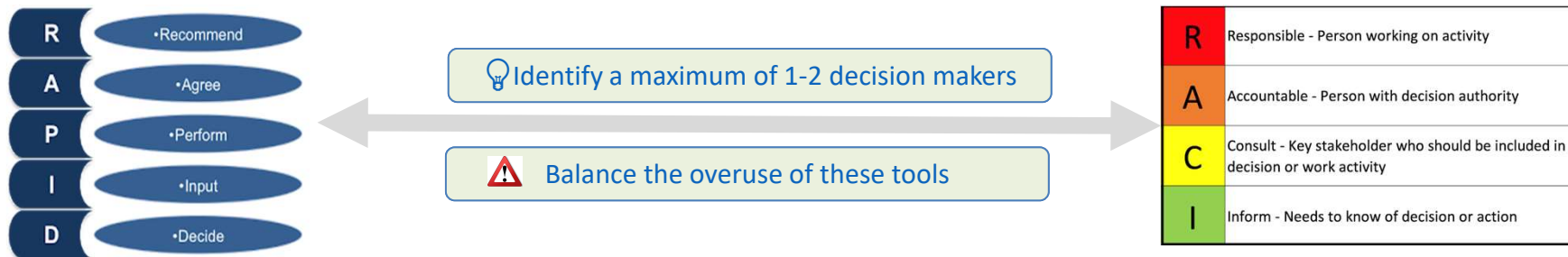- Other…

Growth & Profitability

Key items to be agreed on

- *Value proposition:* What problems need to be solved?
- *In scope:* Line of Business, Market Segments, Regions and other
- *Types of Use Case* : Implementation w/ IT Support vs. Soft Guidance vs. R&D Capability
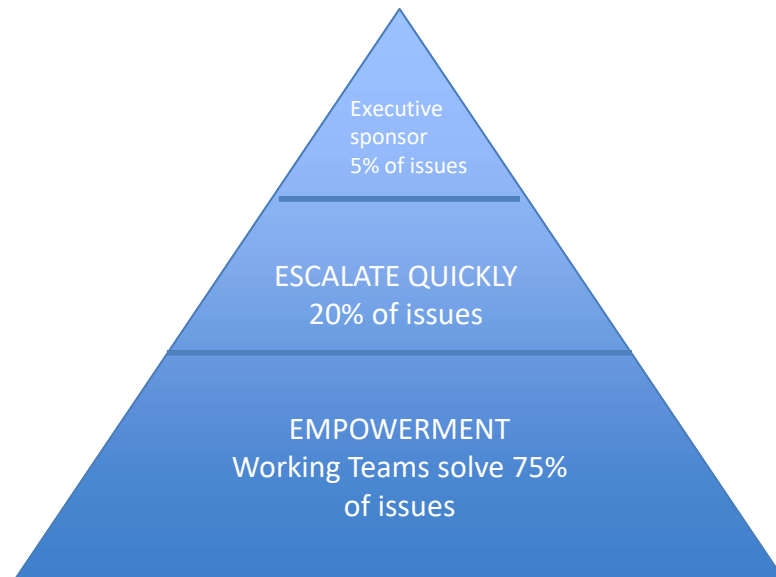- *Time Line:* **Make it Finite!**

RAPID or RACI: Find the one decision maker !

1. Establish decision making and escalation framework before you begin the project.

R	•Recommend
A	•Agree
P	•Perform
I	•Input
D	•Decide

💡 Identify a maximum of 1-2 decision makers

⚠ Balance the overuse of these tools

R	Responsible - Person working on activity
A	Accountable - Person with decision authority
C	Consult - Key stakeholder who should be included in decision or work activity
I	Inform - Needs to know of decision or action

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2. Culture: Know the power structure and dynamics of your stakeholders

Executive sponsor
5% of issues

ESCALATE QUICKLY
20% of issues

EMPOWERMENT
Working Teams solve 75%
of issues

⚠ Balance the need for everyone to vote at all times on all choices

💡 Identify roadblocks vs speed-bumps

💡 HIT PAUSE and correct if certain roles or process needs to be re-evaluated.

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Staying away from <u>black box</u> cultures

A black Box which combines DS model and Actuarial process is often fraught with delays in buy-in and troubleshooting with blurred lines of accountability.
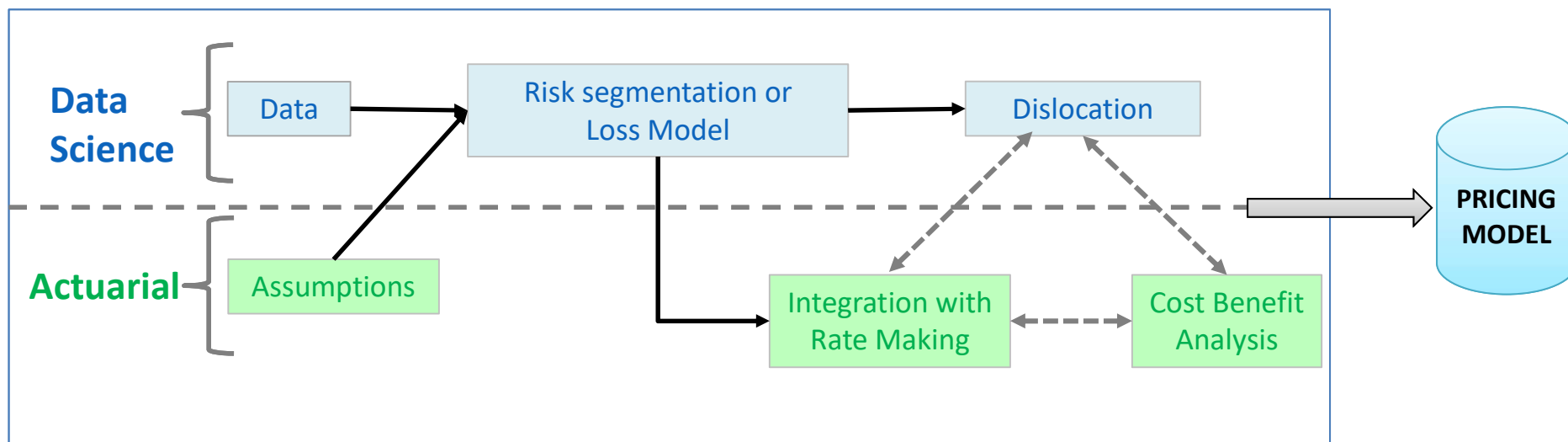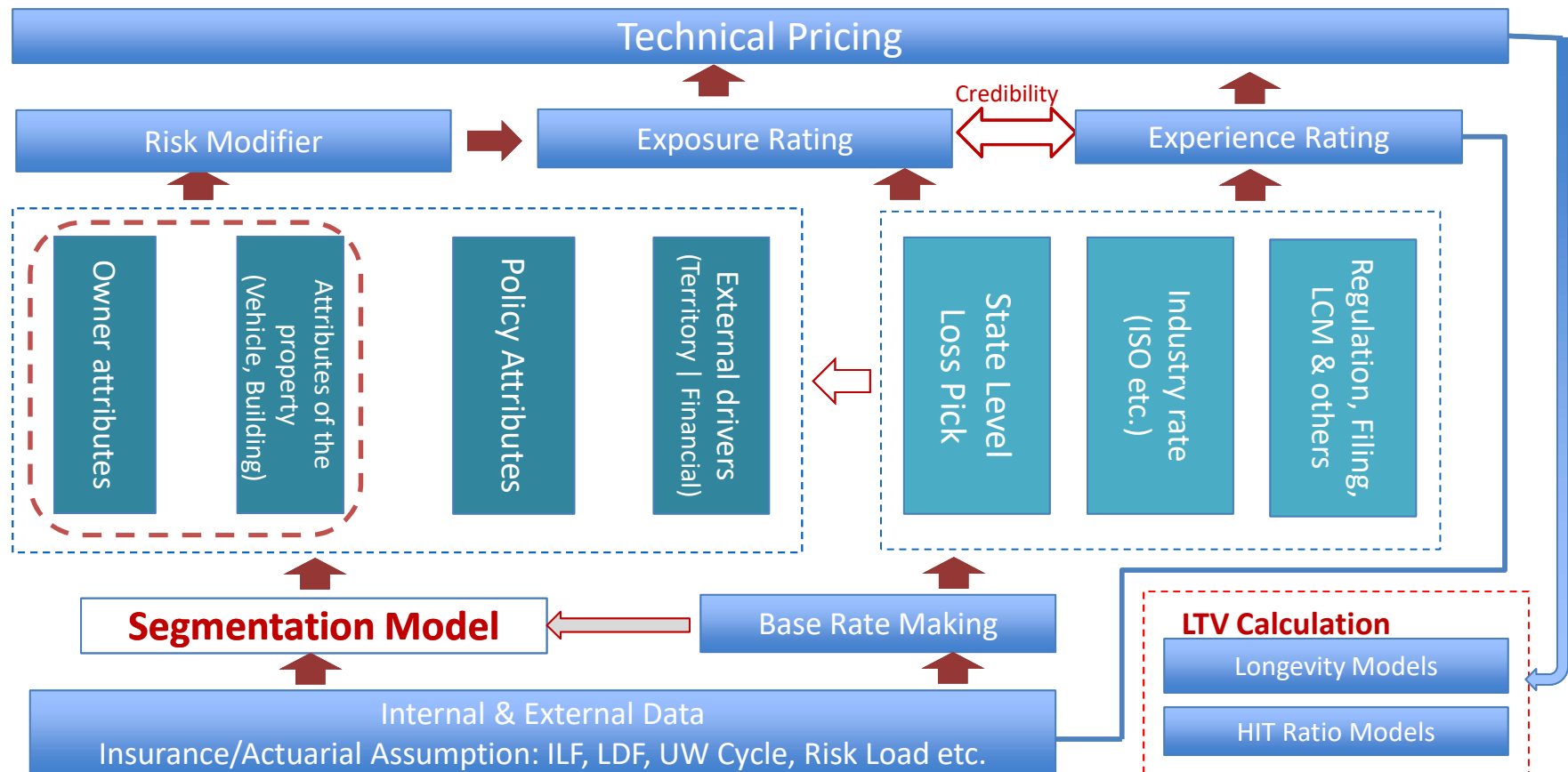

1. **Separate risk segmentation from ratemaking**: The best outcome is when the same variables are behind both risk segmentation and rate making, but this is hardly ever the case.
Helps troubleshoot if model is not working vs rates are too high

2. The roles and responsibilities can exist in either department as long as there is **transparency on the accountability**

3. If historical data is not applicable to the portfolio of the future, then **DO NOT FEED** such data into ratemaking or risk segmentation. Explore 3rd party and industry data

Pricing frameworks are complex with multiple modular components

Technical Pricing

Risk Modifier ➡ **Exposure Rating** ⬌ *Credibility* **Experience Rating**

- Owner attributes
- Attributes of the property (Vehicle, Building)
- Policy Attributes
- External drivers (Territory | Financial)
- State Level Loss Pick
- Industry rate (ISO etc.)
- Regulation, Filing, LCM & others

Segmentation Model ⬅ **Base Rate Making**

LTV Calculation
- Longevity Models
- HIT Ratio Models

Internal & External Data
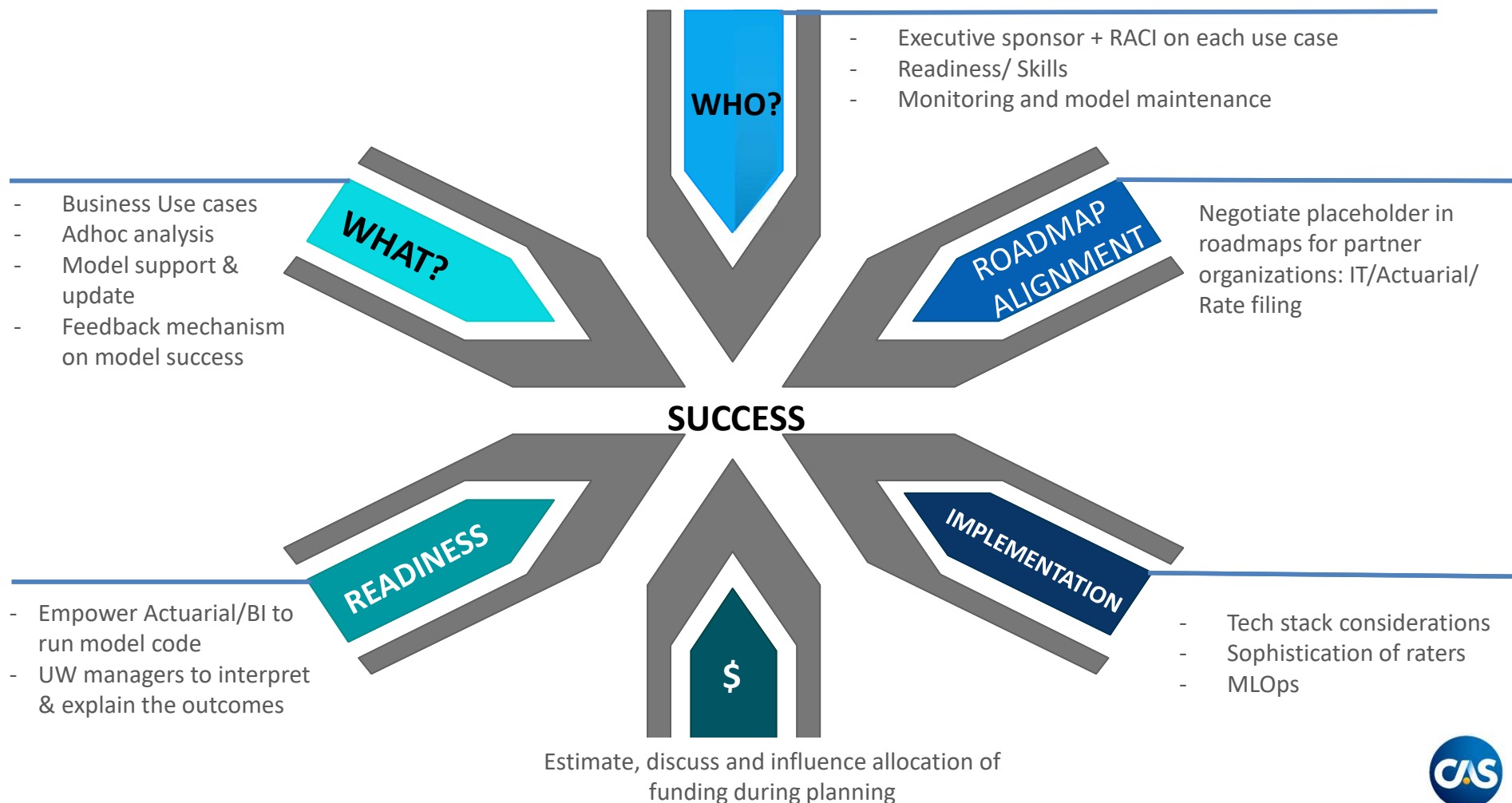Insurance/Actuarial Assumption: ILF, LDF, UW Cycle, Risk Load etc.

💡 Pricing Framework has many complex sub-components: Prioritize the urgent items that need to be addressed

💡 While the SME may exist amongst multiple departments, each working group should develop a holistic understanding of the assumptions being input and implications of the output.

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The "Handoff"

Who are you handing off to? Have a stake or a seat at the table during the next steps till desired result is achieved

Negotiate placeholder blocks in IT roadmaps before/during project

WHO?
- Executive sponsor + RACI on each use case
- Readiness/ Skills
- Monitoring and model maintenance

WHAT?
- Business Use cases
- Adhoc analysis
- Model support & update
- Feedback mechanism on model success

ROADMAP ALIGNMENT

Negotiate placeholder in roadmaps for partner organizations: IT/Actuarial/ Rate filing

SUCCESS

READINESS
- Empower Actuarial/BI to run model code
- UW managers to interpret & explain the outcomes

IMPLEMENTATION
- Tech stack considerations
- Sophistication of raters
- MLOps

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Estimate, discuss and influence allocation of funding during planning

Example: Scoping Vehicle Level Modeling in PAL

Features % increase dramatically in

New data sources enable modeling based on safety features.
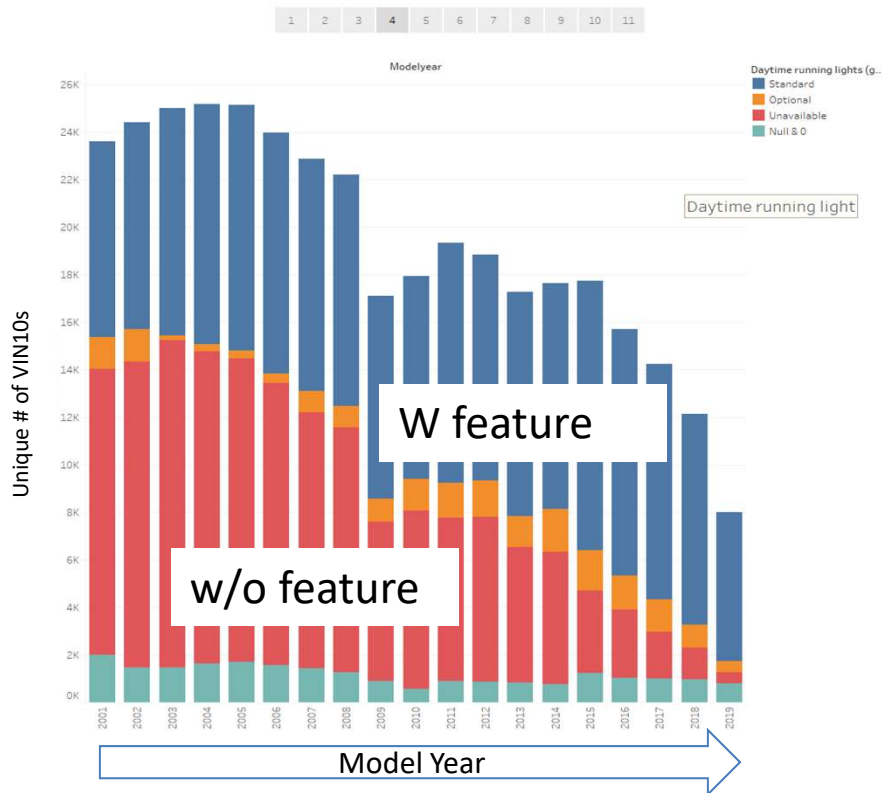
- Daytime Running Lights
- Anti-Theft Device
- Adaptive Cruise Control
- Blind Spot Warning
- Lane Departure Warning
- Collision Preparation
- Rear View Camera
- Night Vision
- Driver Alertness
- More …

Background and Business Problem

- New data sources makes safety features available to price an auto insurance policy
- However, no structured database to provide standardized feature classification
- Developing takes long time, with pressures to deliver it cost-effectively and quickly
- Needs seamless collaboration between Data Science, Actuaries and multiple Stakeholders

Consistent Governance Structure driving incremental wins!

Goal: Finish all work in 9 months!

Communication Plan

- Bi-weekly Advisory update
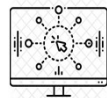- Weekly working session
- Daily working team huddle

Driver-Vehicle interaction Driverless car

How much we know drivers and cars know each other?

Beyond Year, Make, Style Feature models

Big Data
Machine Learning
NLP
Credibility Theory

Household Pricing High-dimensional Interaction

Big Data
Machine Learning
Credibility Theory

GLM
Driver Models Experience Rating Merit tables

GLM
Bonus-Malus
point system

Credit Revolution

Banking
Credit card
PRG

Advisory Board

- Head of Data Science
- State Manager 1
- State Manager 2
- Chief Actuary
- Claim Manager
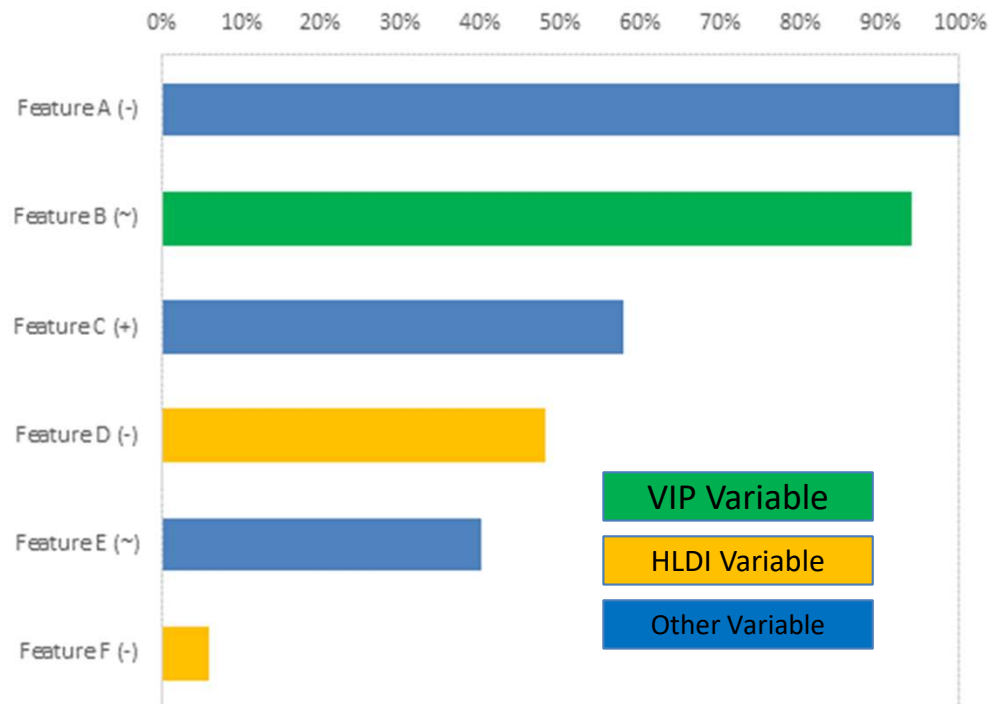
Accountable Executive
CPO
Responsible Team
Data Scientists
Actuarial
Product Analysts

Consulting/Informing

Other Channel/IT

Example Outputs from the Responsible Team

Variable Importance Index and Gini-Index

	Training	Holdout*
OLEP	0.1858	0.1919
Model w/o Vehicle Age	0.1862	0.1927
Model w/ Vehicle Age	0.1876	0.1944

Data Scientists

- Text-mined auto sales website
- Standardized and categorized features
- Build car feature database
- Variable selection with machine learning
- Provide expansibility via GLM/GAM and Credibility, then made recommendation
- Built monitoring report and on-demand rescoring capability
- Learnings & Teamwork!

Actuaries & Product

- Provided actuarial assumptions, trending, LDF and other actuarial consulting
- Provided prospective loss picking/indications
- Validated model performance
- Conducted scenario analysis depending different selection balancing model outputs and dislocation
- Learning & Teamwork!

Concluding Remark

All happy families are alike; each unhappy family is unhappy in its own way

Leo Tolstoy