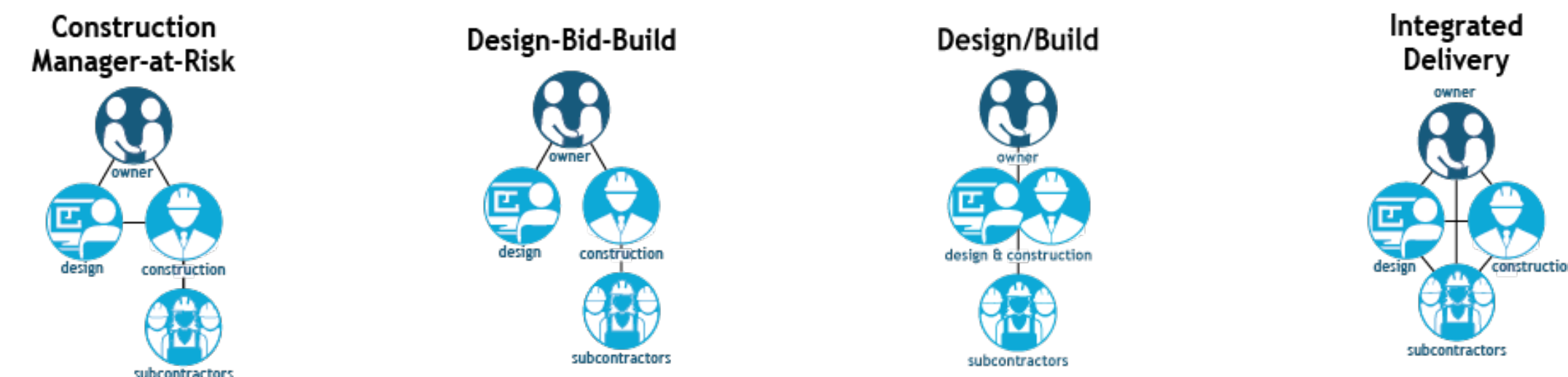


DIVISION OF COST DEVIATIONS IN INTEGRATED
PROJECT DELIVERY SYSTEMS USING
COOPERATIVE GAME THEORYYomna Emad¹, Mohamed S. Eid², Hesham A. Bassioni³Email: yomna.mansour@student.aast.edu

INTRODUCTION

Definition

IPD is defined as a “project *delivery* method that *integrates* people, systems, business structures and practices into a process that collaboratively harnesses the talents and insights of all participants to reduce waste and optimize efficiency through all phases of design, fabrication and construction,” (AIA CC 2014).

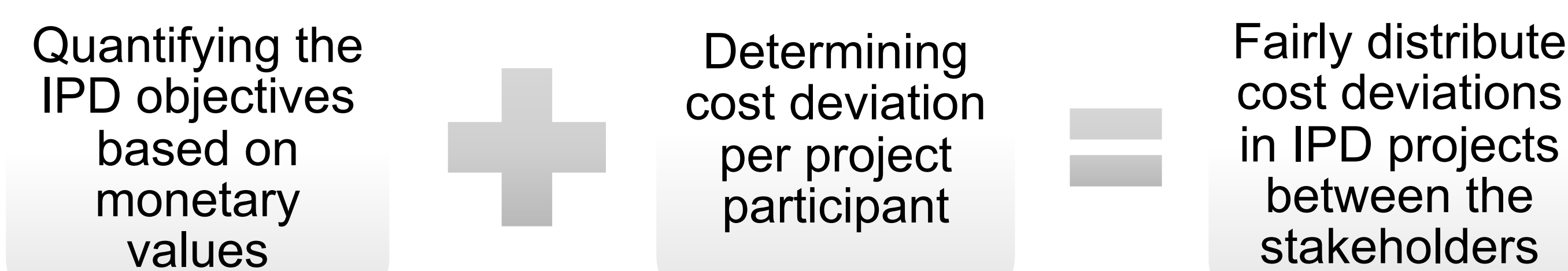


Background

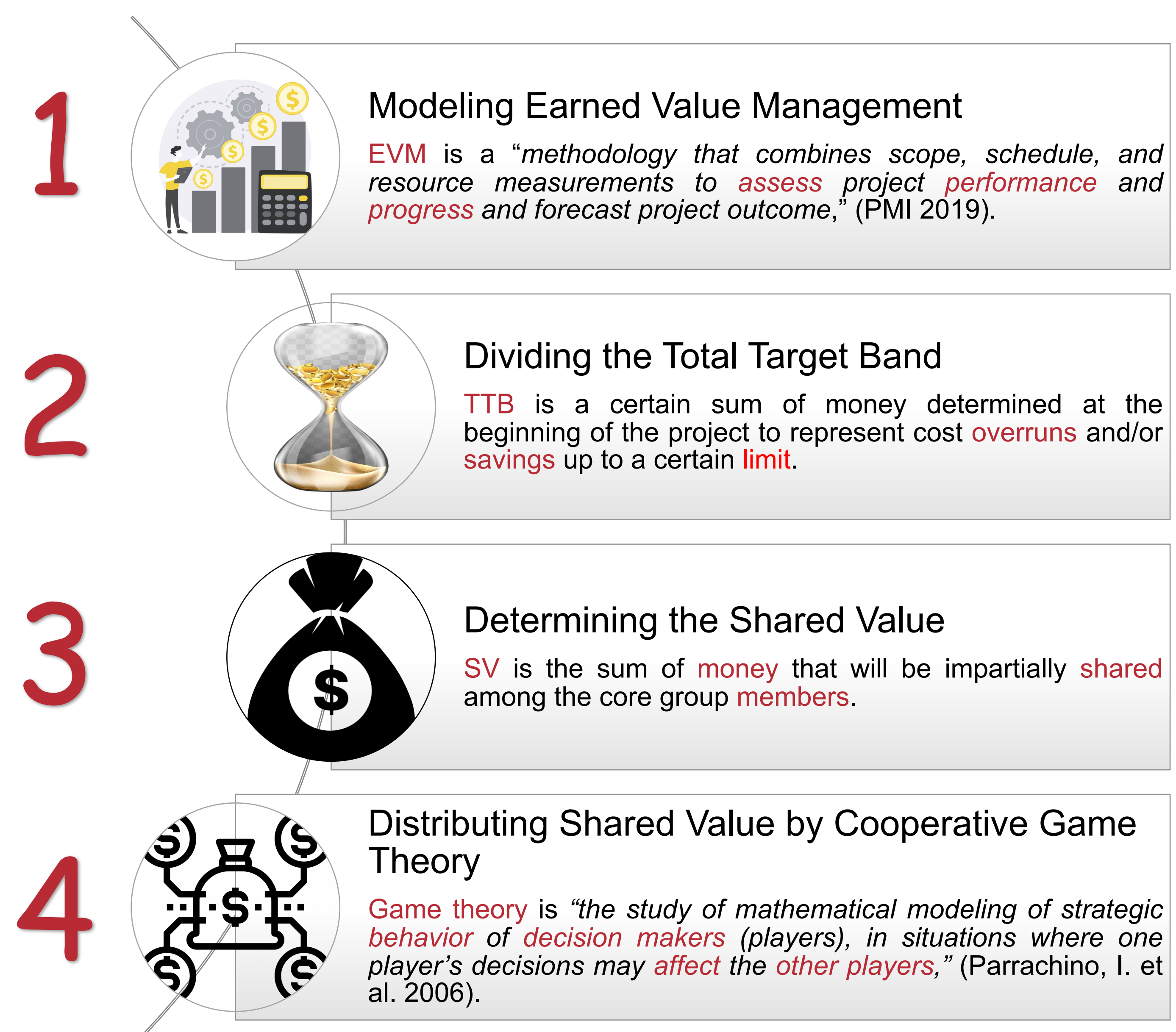
One of the main contractual issues faced in IPD projects under the two contract forms *AIA-C191* & *ConsensusDocs 300* is the **identification**, **management** & **allocation** of cost deviations using well defined strategies and adequate plans (Ahmed et al. 2021 & Eissa et al. 2024).

An IPD project survival is difficult with an unreasonable **distribution mechanism** for risk & reward sharing (Guo et al. 2022).

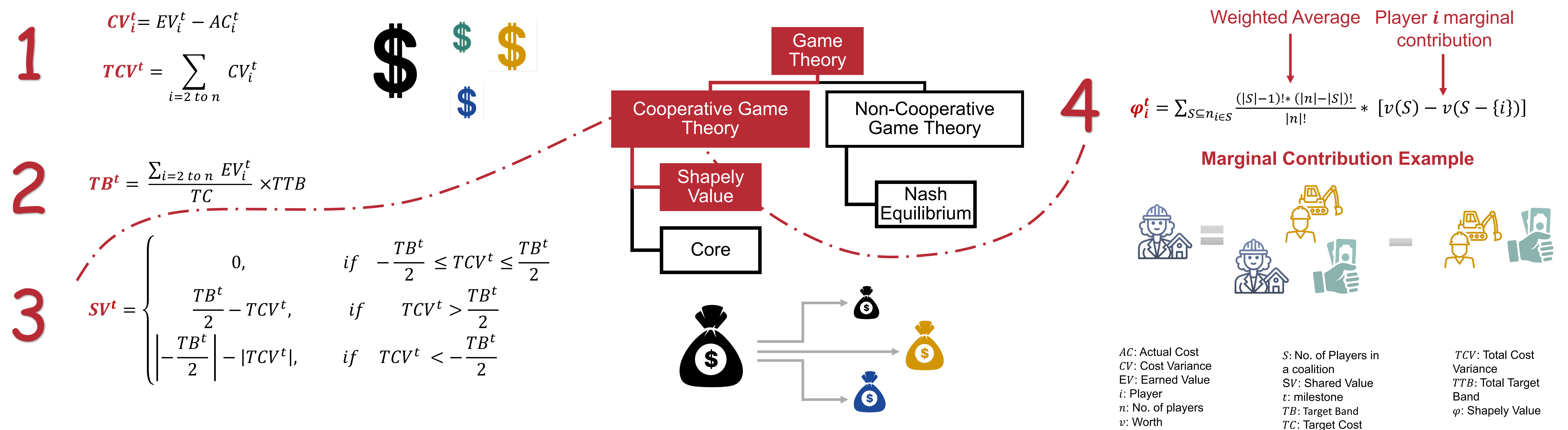
GOAL & OBJECTIVES



PROJECT METHODOLOGY



MODEL DEVELOPMENT



CASE STUDY

IPD Project Information

- Project Name: Barrie-Simcoe Emergency Services Campus (BSESC) (Staub-French et al. 2022)
- Budget: \$85,799,954
- Duration: 38 months
- Core Group Members: Owner, Architect, & Contractor

Assumptions

- Total Target Band (TTB): \$8,579,995
- Target Cost (TC): \$72,929,962
- Actual Cost (AC): \$76,000,313
- Project Milestones (T): 6
- Contractor Scope: 90% of TC
- Architect's Scope: 10% of TC



Note: All numbers are in Millions

Value Description	Work Value at t for t = 1 to 6					
	Months 1-6	Months 7 to 12	Months 13-18	Months 19-24	Months 25-30	Months 31-38
Architect's CV_2^t	\$0.0944	\$0.263	\$0.0197	\$0.0197	\$0.0197	\$0.007
Contractor's CV_3^t	\$0.0164	-\$0.028	-\$1.065	-\$1.293	-\$1.293	-\$0.228
TCV	\$0.345	\$0.235	\$1.046	-\$1.109	-\$1.273	-\$0.221
TB _t	\$0.468	\$0.539	\$2.293	\$2.317	\$2.538	\$0.426
SV _t	\$0.111	\$0.000	\$0.000	\$0.000	-\$0.004	-\$0.008

Note: All numbers are in Millions

Value Description	Work Value at t for t = 1 to 6					
	Months 1-6	Months 7 to 12	Months 13-18	Months 19-24	Months 25-30	Months 31-38
$v(1), v(2), v(3)$	\$0.000	\$0.000	\$0.000	\$0.000	\$0.000	\$0.000
$v(12)$	\$0.094	\$0.000	\$0.000	\$0.000	\$0.000	\$0.000
$v(13)$	\$0.000	\$0.000	\$0.000	\$0.000	-\$0.0239	-\$0.0148
$v(23)$	\$0.000	\$0.000	\$0.000	\$0.000	\$0.000	\$0.000
$v(123)$	\$0.111	\$0.000	\$0.000	\$0.000	-\$0.004	-\$0.0083
Owner's Shapley ϕ_1	\$0.0527	\$0.000	\$0.000	\$0.000	-\$0.0054	-\$0.0053
Architect's Shapley ϕ_2	\$0.0527	\$0.000	\$0.000	\$0.000	\$0.0066	\$0.0022
Contractor's Shapley ϕ_3	\$0.0055	\$0.000	\$0.000	\$0.000	-\$0.0054	-\$0.0053

Note: All numbers are in Millions

RESULTS & DISCUSSION

- The Owner's shapely value is always equal to that of the member responsible for the overrun/ saving.
- The model accounts for a player's positive contribution and incentivizes them accordingly, even if the overall performance of the project at that milestone is negative.
- The shares of each participant differed based on their contribution to a specific time window of the project.
- Distributing deviations along the project duration would either motivate the group members when incentivized or urge them to proactively avoid further overruns.

INDUSTRY CONTRIBUTION

- Address knowledge gap in *ConsensusDocs 300* and *AIA-C191*.
- Promote collaboration in the booming construction industry.
- Ease IPD adoption worldwide.

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