Figure 1 – Sales, Profit, and Other Measures of Financial Performance

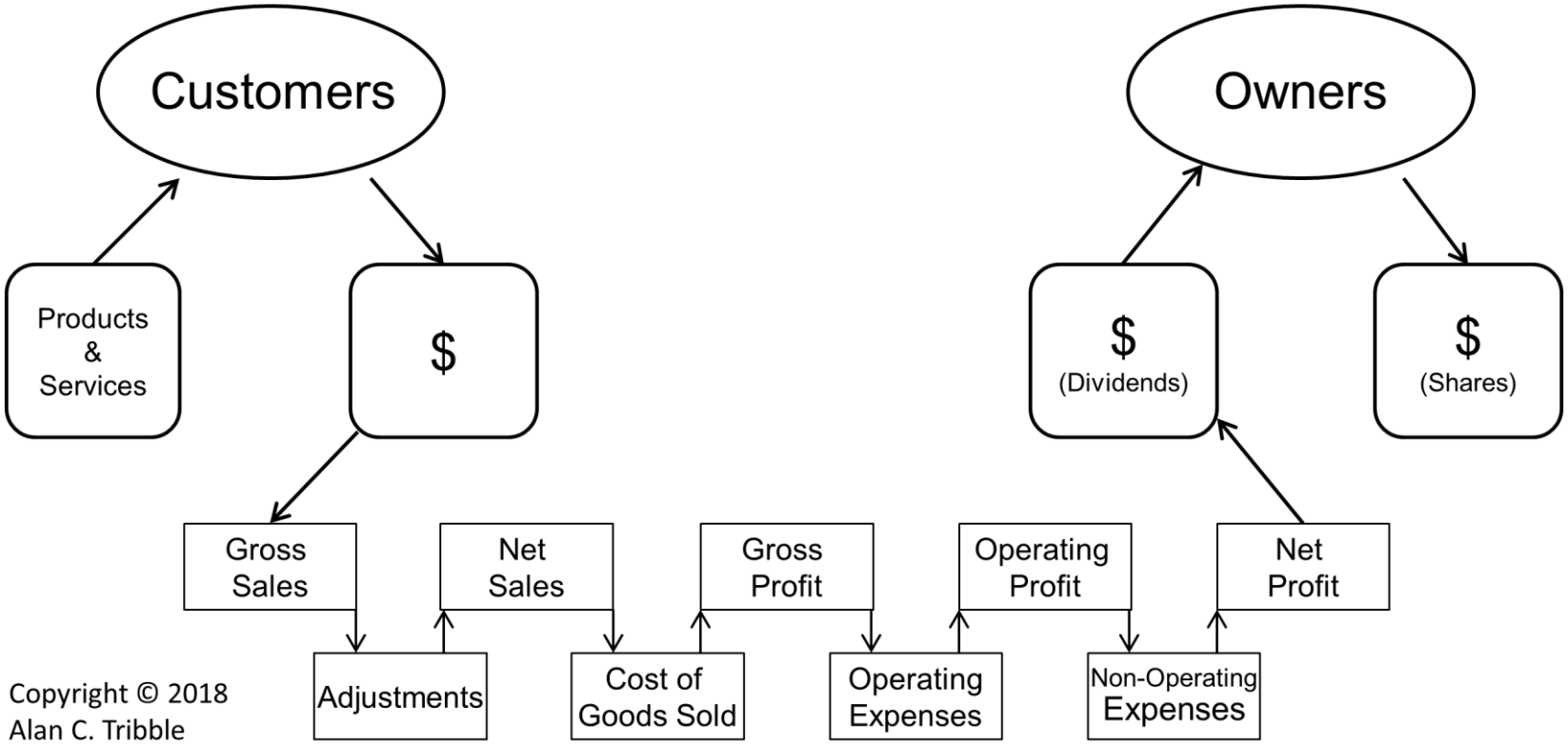


Figure 2 – Balancing the Needs of Customers and Owners

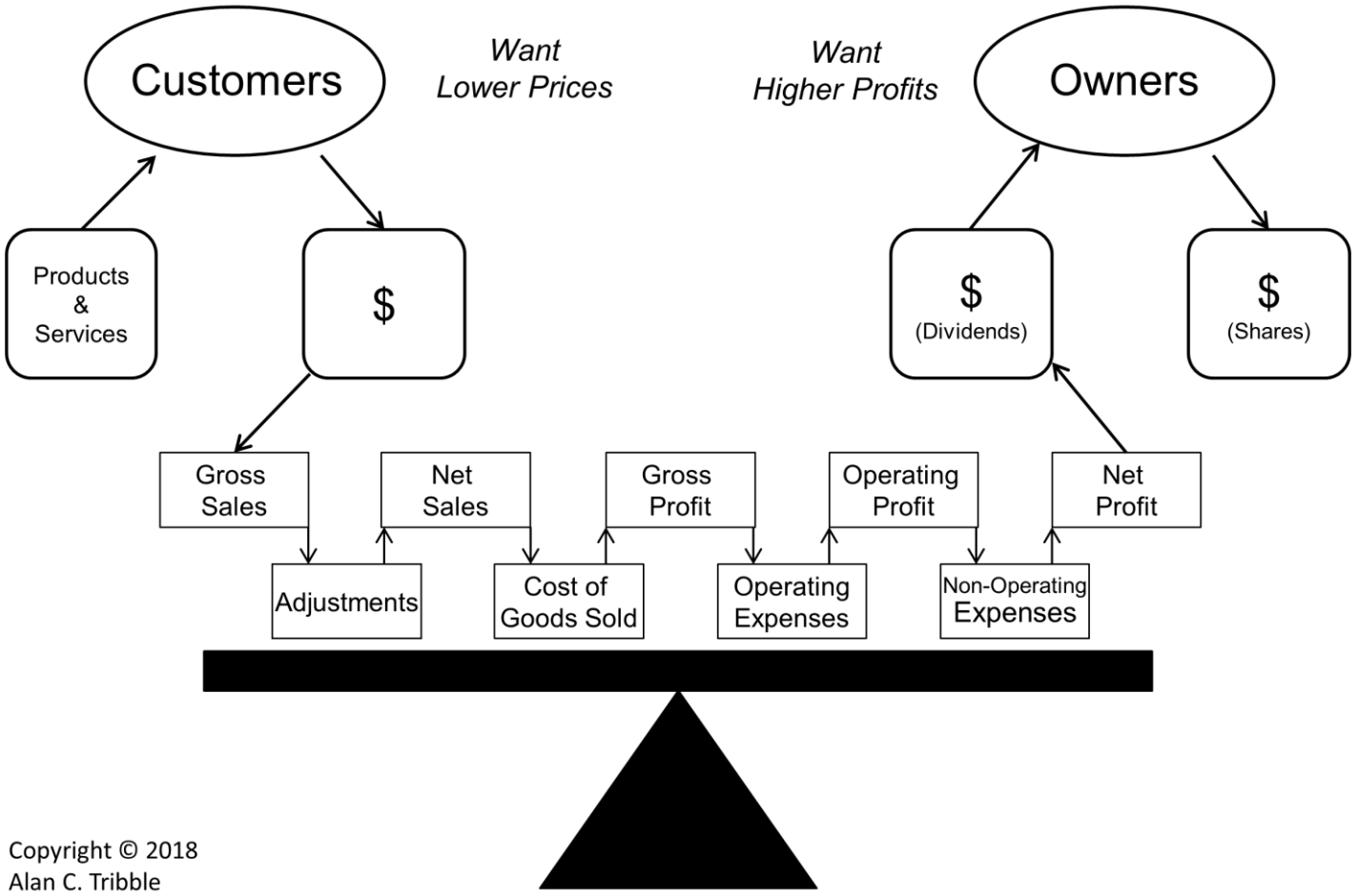
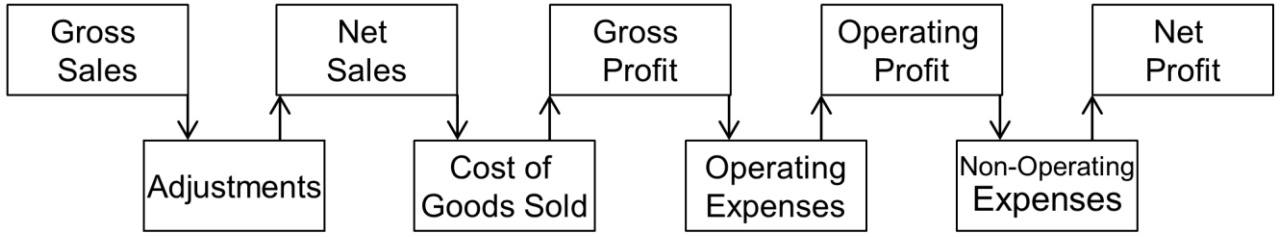


Figure 3 – Examples of Discretionary Expenses



Returns
Allowances
Discounts

Material
Labor

Internal Research & Development
Bid & Proposal
Pre-Planned Product Improvement

General &
Administrative
Rent
Utilities
Mgmt Salaries
Benefits
Travel
IR&D
B&P
P3I

Selling
Advertising
Commissions

New Capital
Amortization
Depreciation

Prior Capital
Amortization
Depreciation

Interest
Taxes

Figure 6 – NASA Organizational Structure

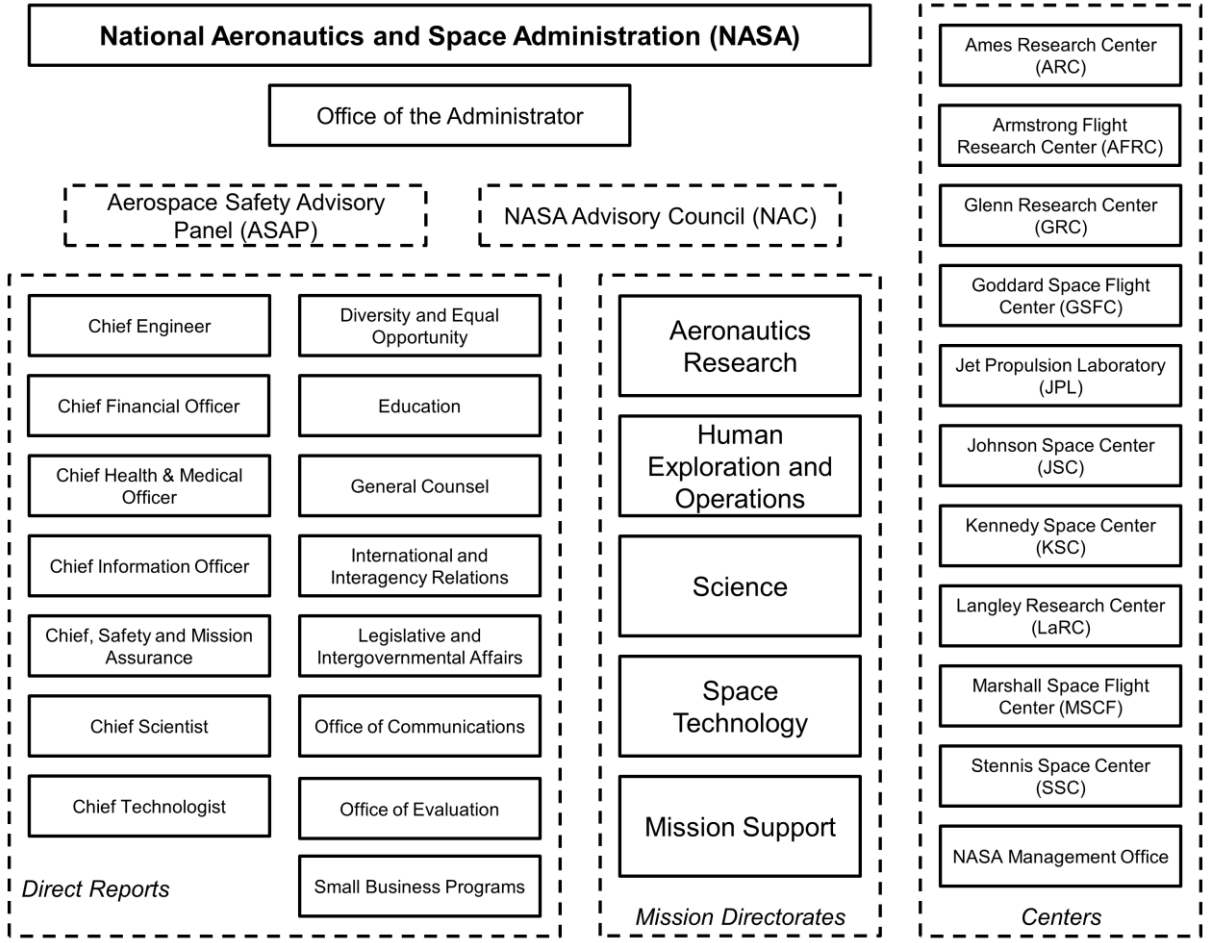


Figure 26 – Cost vs Time for a Project with a Linear Work Rate

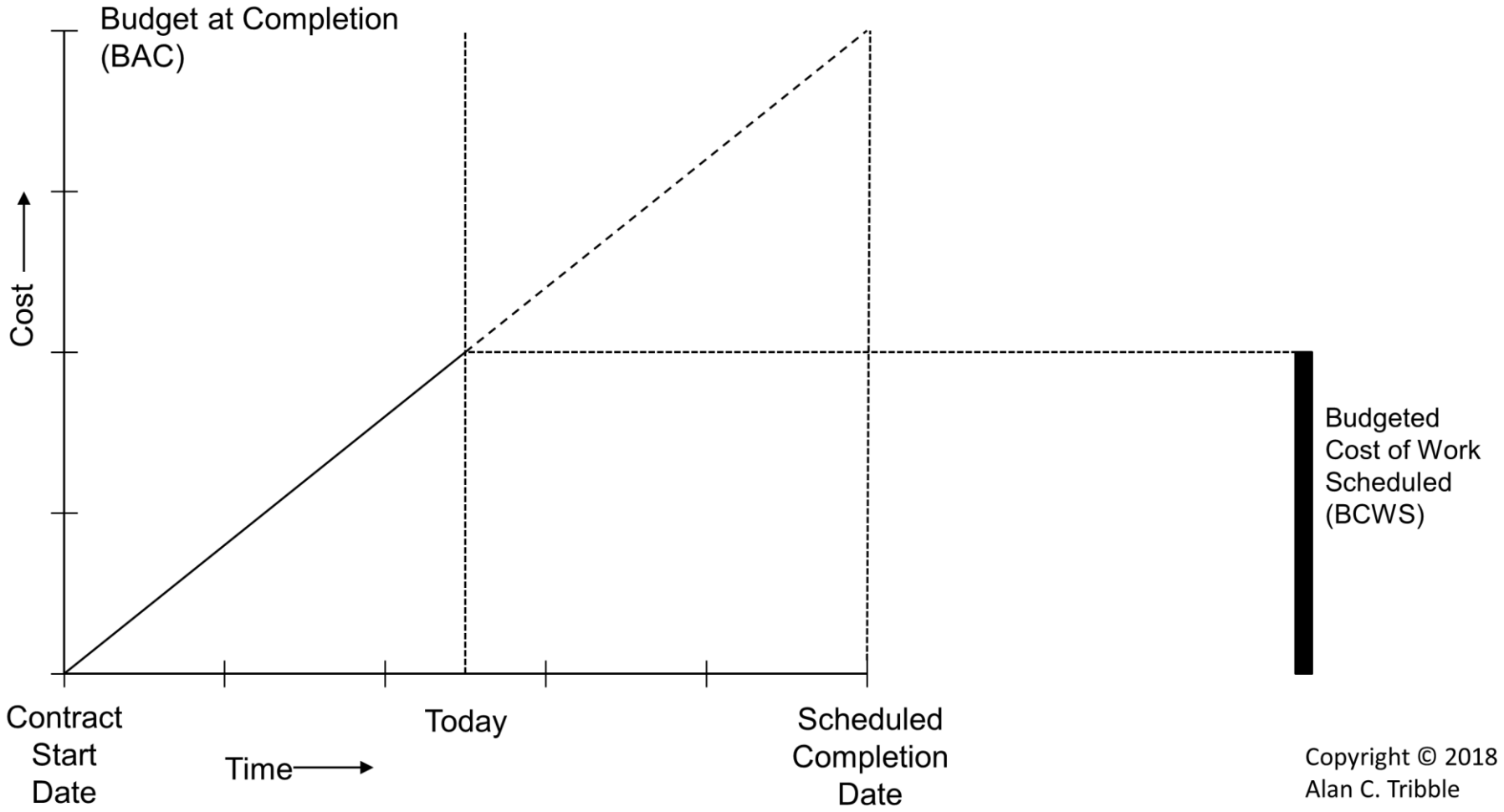


Figure 27 – Actual Cost Growing at a Rate Below That of the Work Scheduled

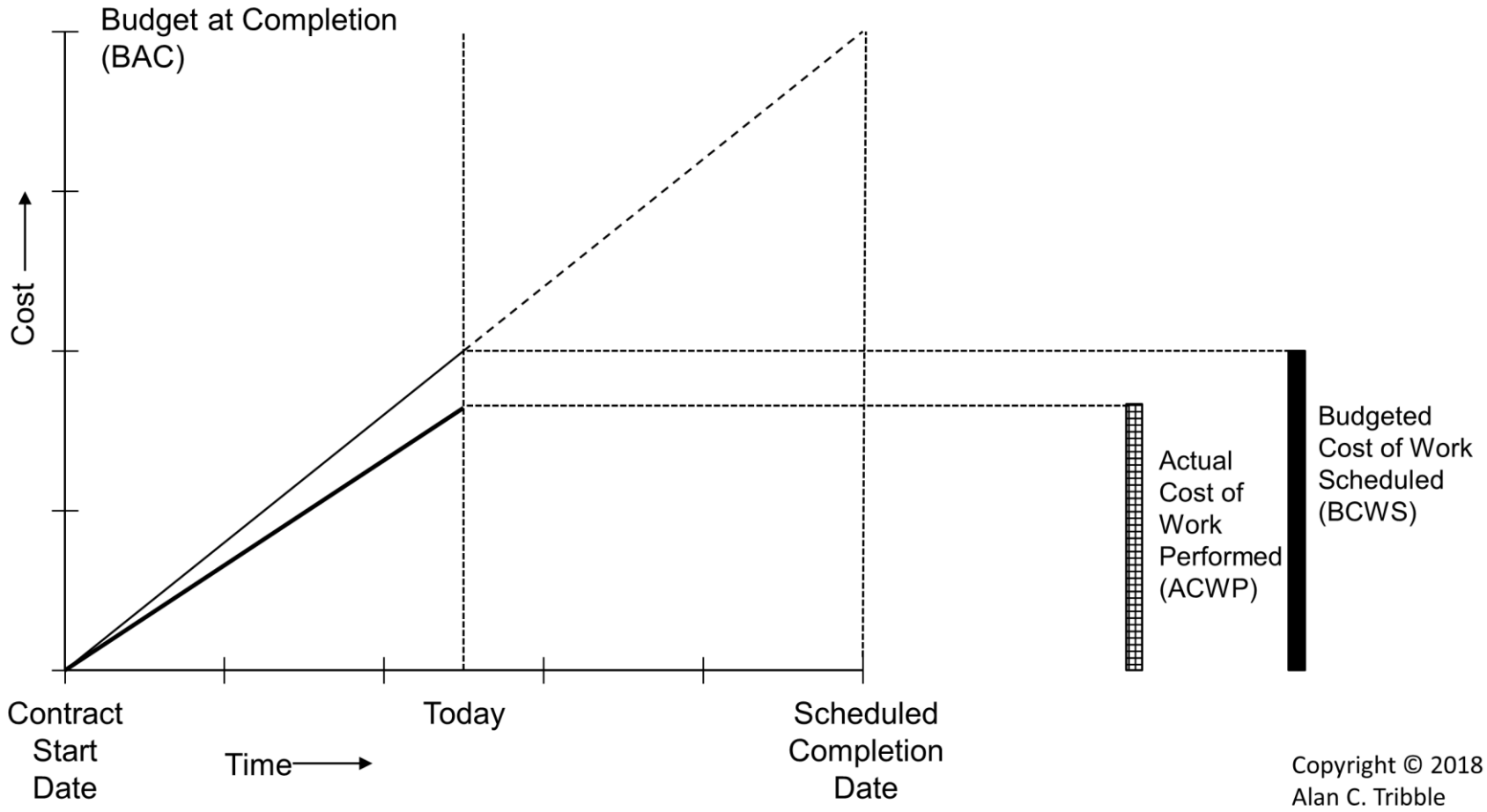


Figure 28 – Example of BCWS, ACWP, and BCWP all Growing at Different Linear Rates

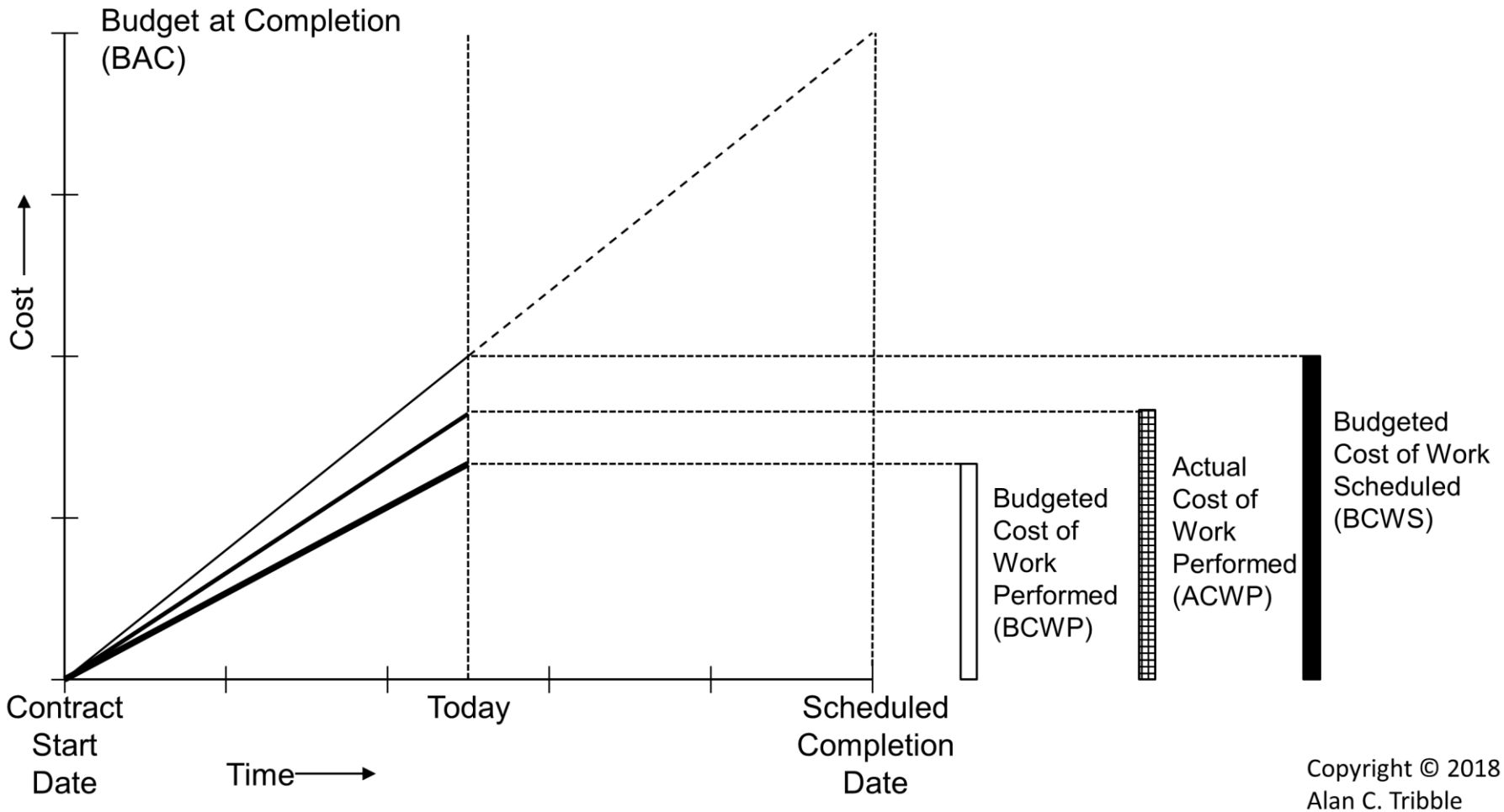


Figure 29 – Cost and Schedule Variance

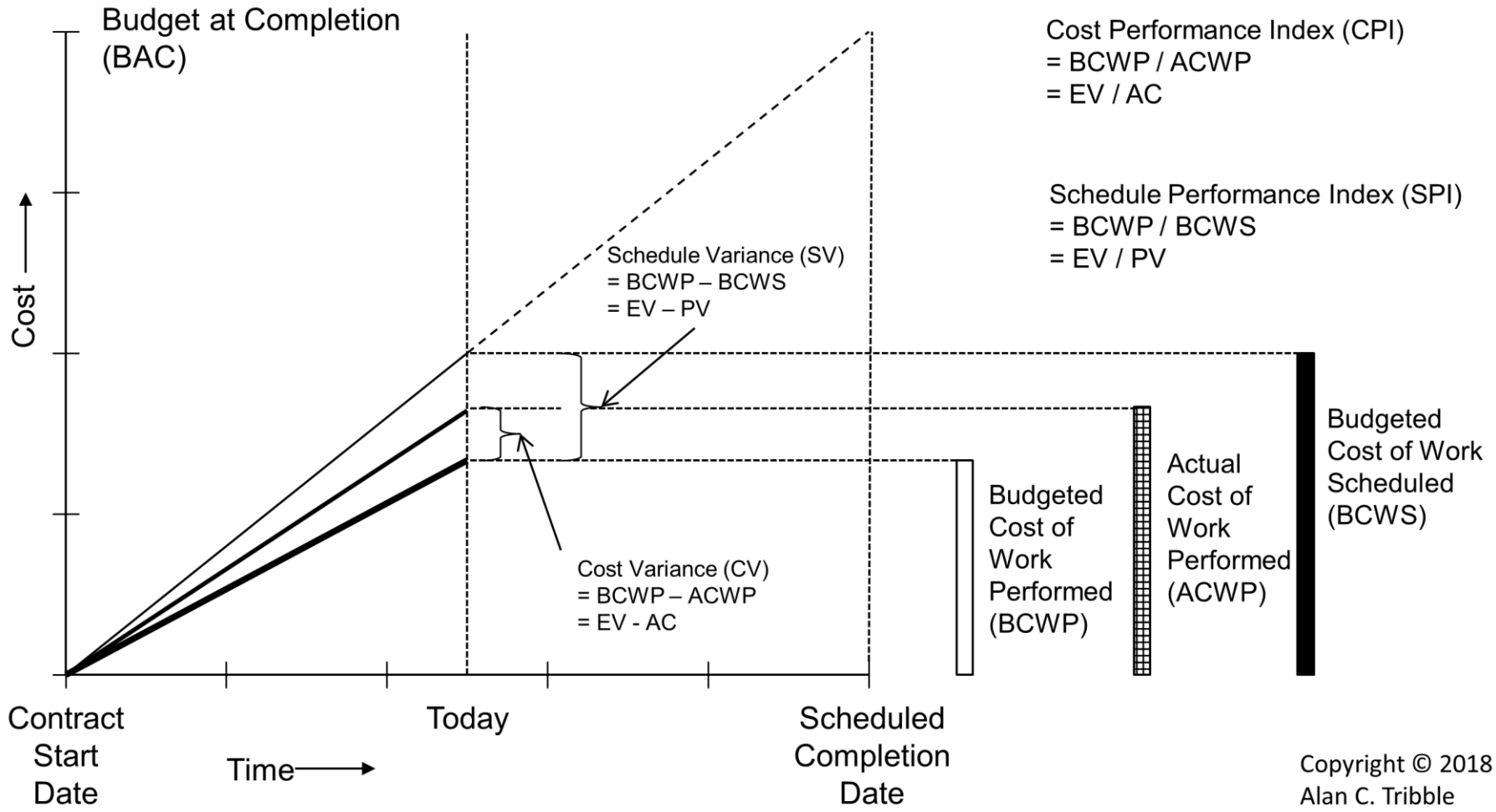


Figure 30 – Cost and Schedule Overruns

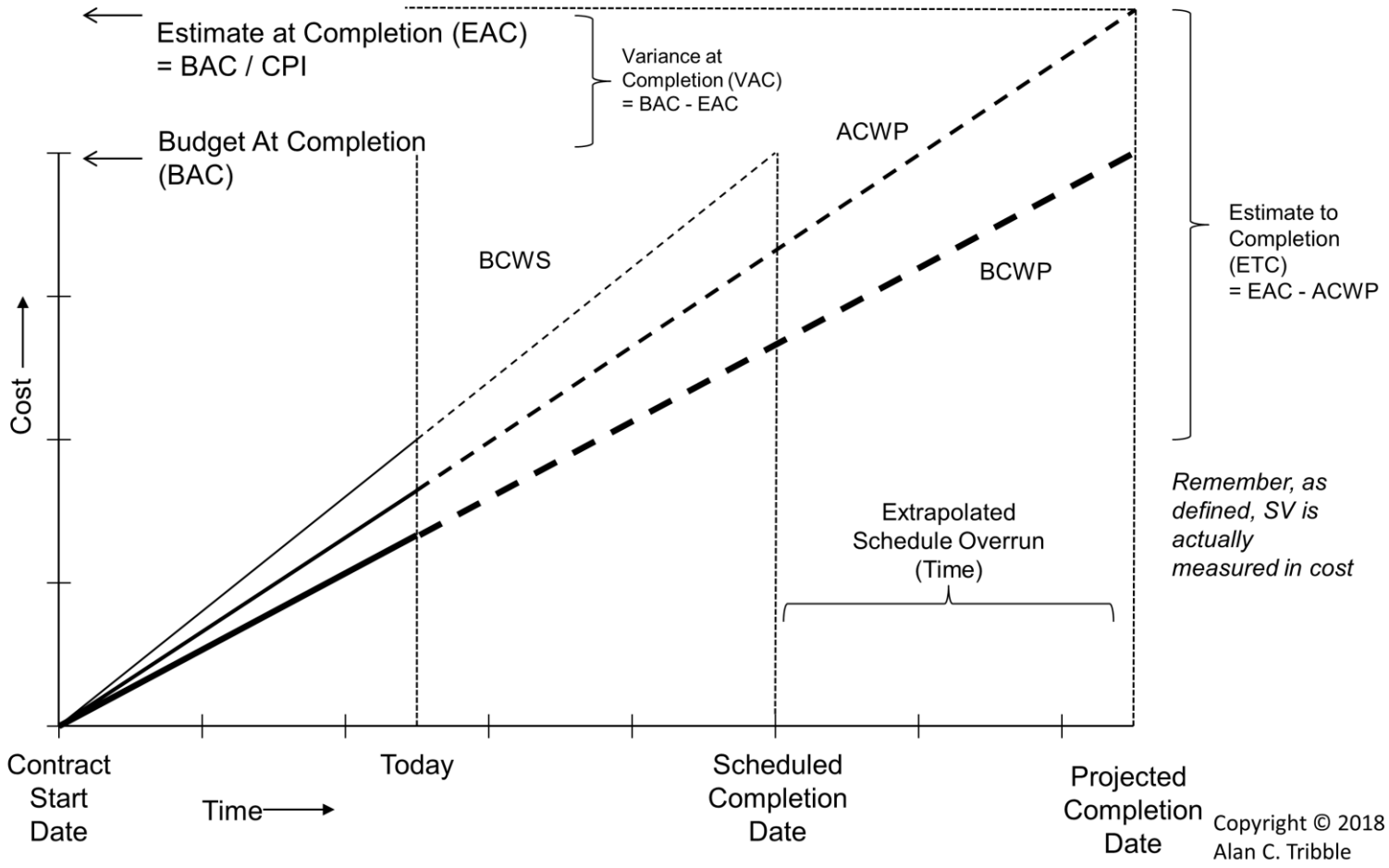


Figure 31 – Work to be Performed, Cost to be Expended, and Work to be Scheduled

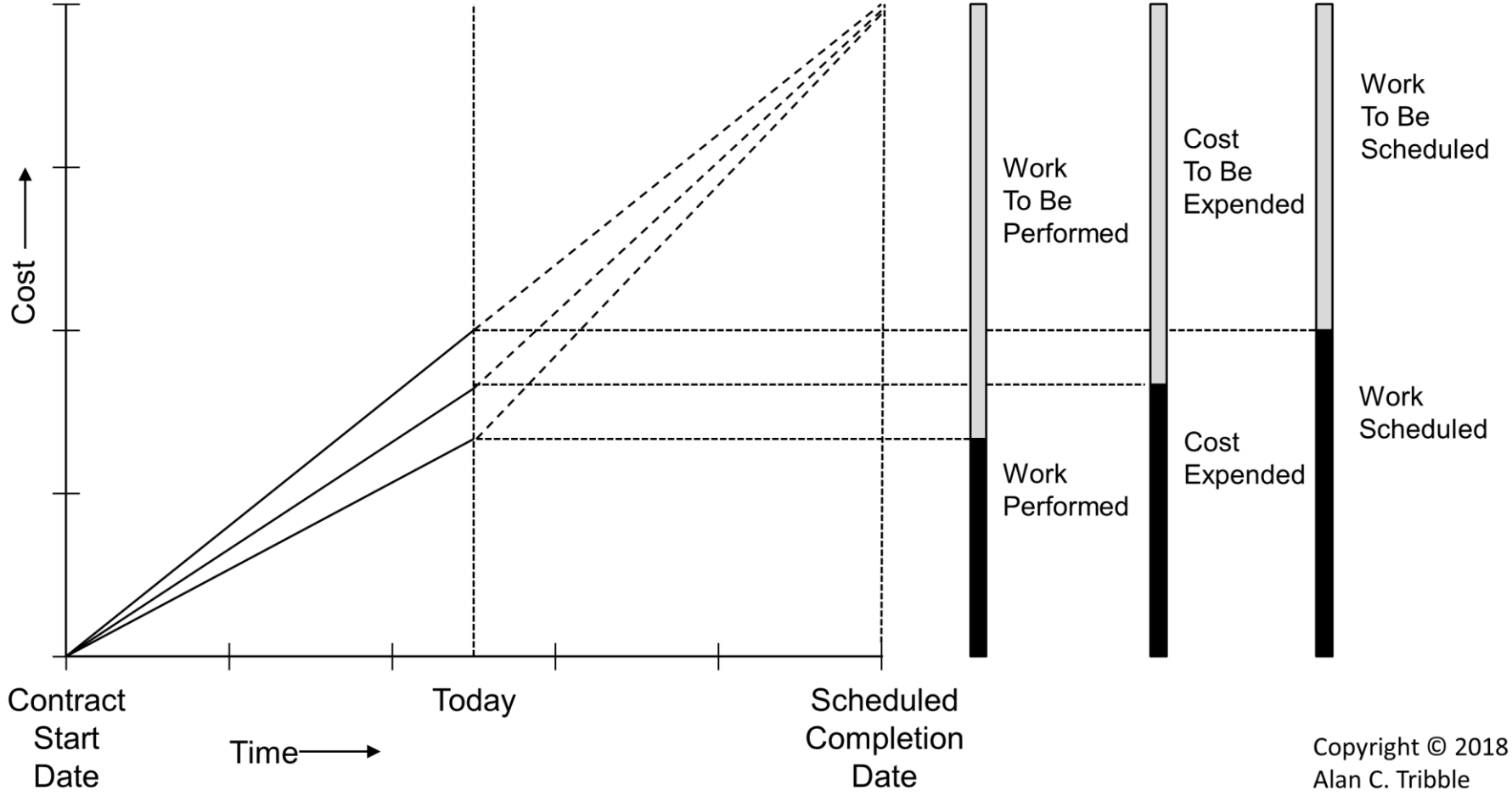


Figure 34 – Notional BCG Matrix

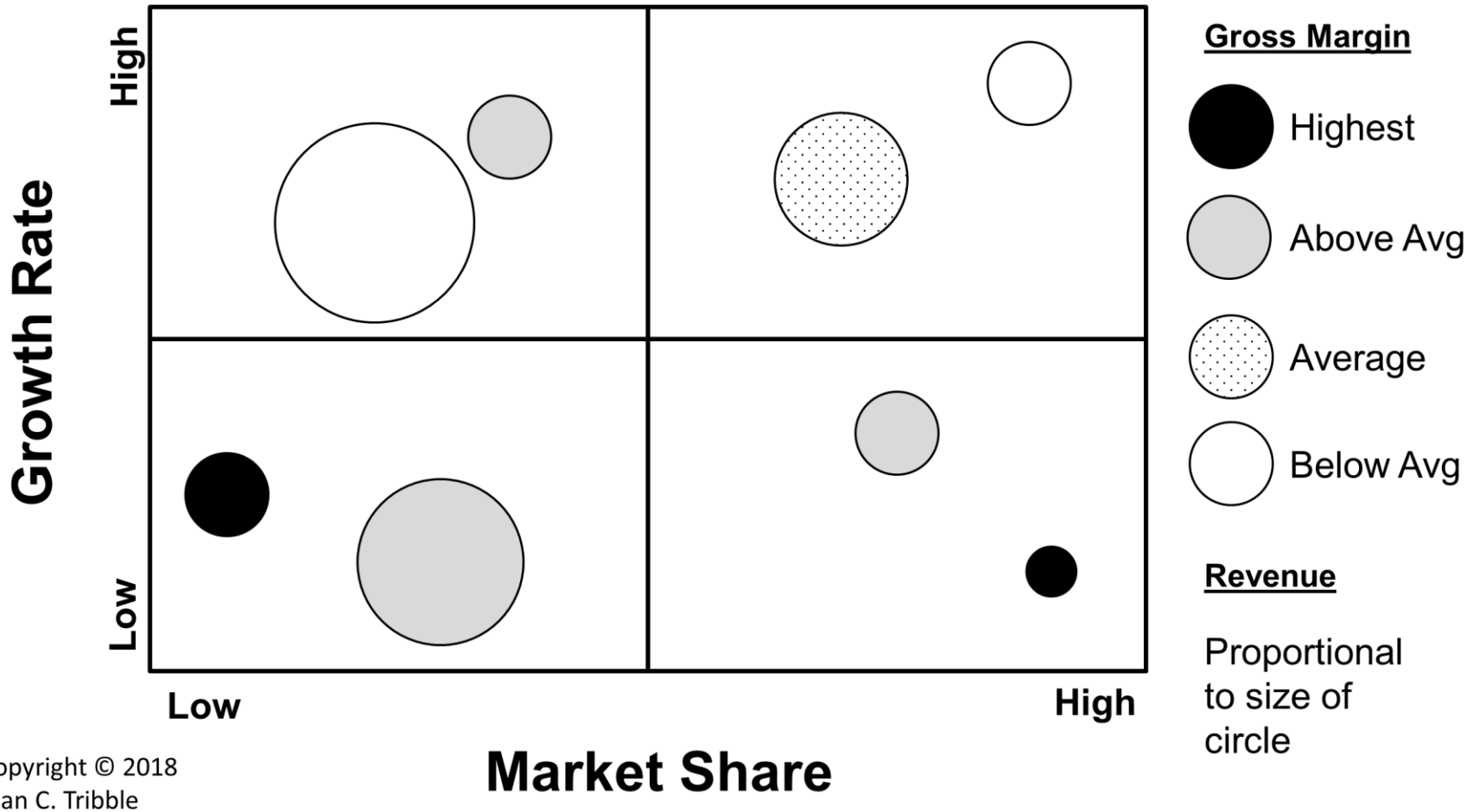


Figure 35 – Interpretation of the BGC Matrix

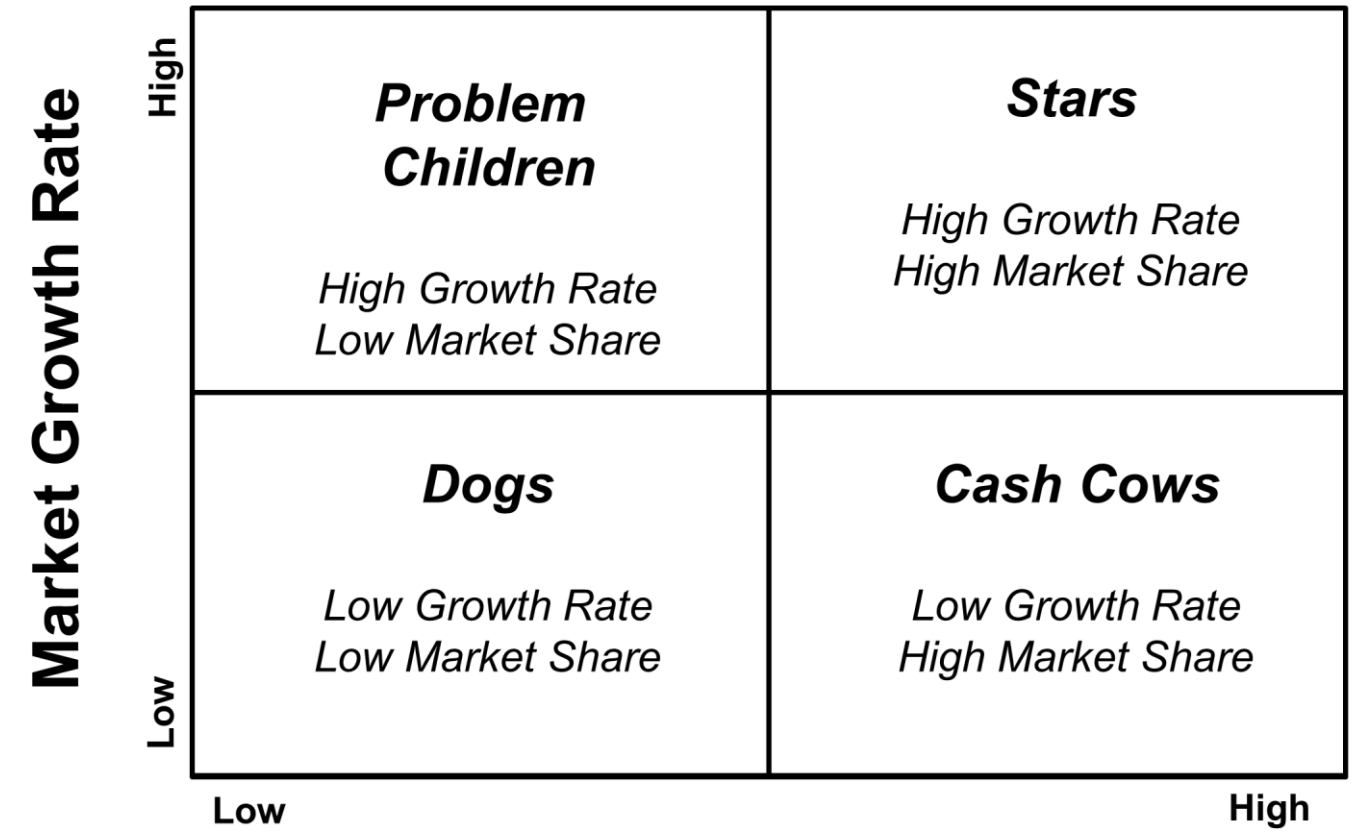


Table 1. The Ten Largest Stock Markets.

Rank	Stock Exchange	Symbol	Country	Approximate Market Capitalization ($B US)	Approximate Number of Companies (Listings)
1	New York Stock Exchange	NYSE	United States	$ 19,600	2,400
2	National Association of Security Dealers Automated Quotations	NASDAQ	United States	$ 8,130	3,000
3	London Stock Exchange	LSE	United Kingdom	$ 5,120	3,000
4	Tokyo Stock Exchange	JPX	Japan	$ 4,270	2,300
5	Shanghai Stock Exchange	SSE	China	$ 3,610	1,000
6	Hong Kong Stock Exchange	HKEX	China	$ 3,490	1,900
7	Euronext Amsterdam Stock Exchange	Euronext	European Union	$ 3,370	1,300
8	Toronto Stock Exchange	TSX	Canada	$ 3,240	1,500
9	Shenzhen Stock Exchange	SZSE	China	$ 2,070	1,400
10	Frankfurt Stock Exchange	FSX	Germany	$ 1,770	3,800

Table 2. The Ten Largest Companies

Rank	Company	Exchange	Revenue ($B)
1	Walmart	NYSE	$ 485.9
2	State Grid Corp	NA - Private	$ 315.2
3	Sinopec Group	HKEX, LSE, NYSE, SSE	$ 267.5
4	China National Petroleum	NA - Private	$ 262.6
5	Toyota Motor	LSE, NYSE, TYO	$ 254.7
6	Volkswagen	FSE	$ 240.3
7	Royal Dutch Shell	Euronext, LSE, NYSE	$ 240.0
8	Berkshire Hathaway	NYSE	$ 223.6
9	Apple	NASDAQ	$ 215.6
10	Exxon Mobil	NYSE	$ 205.0

Table 3. Aerospace and Defense Companies by Revenue.

Rank	Company	Country	Revenue ($M)
1	Lockheed-Martin	United States	$ 43,468
2	Boeing	United States	$ 29,500
3	BAE Systems	United Kingdom	$ 23,622
4	Raytheon	United States	$ 22,384
5	Northrop-Grumman	United States	$ 20,200
6	General Dynamics	United States	$ 19,696
7	Airbus	Netherlands	$ 12,321
8	L3 Technologies	United States	$ 8,879
9	Leonardo	Italy	$ 8,526
10	Thales	France	$ 8,362

Table 4. Aerospace and Defense Companies by Market Capitalization.

Rank	Company	Country	Market Cap ($M)
1	Boeing	United States	$ 96,877
2	United Technologies	United States	$ 91,316
3	Lockheed-Martin	United States	$ 74,413
4	General Dynamics	United States	$ 53,455
5	Airbus Group	Netherlands	$ 51,501
6	Raytheon	United States	$ 43,072
7	Northrop Grumman	United States	$ 41,466
8	Safran SA	France	$ 30,065
9	BAE Systems	United Kingdom	$ 23,084
10	Thales SA	France	$ 20,139

Table 15. The Contents of the US Code.

#	Name	#	Name
1	General Provisions	28	Judiciary and Judicial Procedure
2	The Congress	29	Labor
3	The President	30	Mineral Lands and Mining
4	Flag and Seal, Seat of Government, and the States	31	Money and Finance
5	Government Organization and Employees	32	National Guard
6	Domestic Security	33	Navigation and Navigable Waters
7	Agriculture	34	Navy (since repealed, and moved to Title 10)
8	Aliens and Nationality	35	Patents
9	Arbitration	36	Patriotic Societies and Observances
10	Armed Forces	37	Pay and Allowances of the Uniformed Services
11	Bankruptcy	38	Veterans Benefits
12	Banks and Banking	39	Postal Service
13	Census	40	Public Buildings, Properties, and Works
14	Coast Guard	41	Public Contracts
15	Commerce and Trade	42	The Public Health and Welfare
16	Conservation	43	Public Lands
17	Copyrights	44	Public Printing and Documents
18	Crimes and Criminal Procedure	45	Railroads
19	Customs Duties	46	Shipping
20	Education	47	Telecommunications
21	Food and Drugs	48	Territories and Insular Possessions
22	Foreign Relations and Intercourse	49	Transportation
23	Highways	50	War and National Defense
24	Hospitals and Asylums	51	National and Commercial Space Programs
25	Indians	52	Voting and Elections
26	Internal Revenue Service	53	*In Review*
27	Intoxicating Liquors	54	National Park Service and Related Programs

Table 16. The Contents of the US Code of Federal Regulations.

#	Name	#	Name
1	General Provisions	26	Internal Revenue
2	Grants and Agreements	27	Alcohol, Tobacco Products and Firearms
3	The President	28	Judicial Administration
4	Accounts	29	Labor
5	Administrative Personnel	30	Mineral Resources
6	Domestic Security	31	Money and Finance: Treasury
7	Agriculture	32	National Defense
8	Aliens and Nationality	33	Navigation and Navigable Waters
9	Animals and Animal Products	34	Education
10	Energy	35	Reserved (formerly Panama Canal)
11	Federal Elections	36	Parks, Forests, and Public Property
12	Banks and Banking	37	Patents, Trademarks, and Copyrights
13	Business Credit and Assistance	38	Pensions, Bonuses, and Veterans' Relief
14	Aeronautics and Space	39	Postal Service
15	Commerce and Foreign Trade	40	Protection of Environment
16	Commercial Practices	41	Public Contracts and Property Management
17	Commodity and Securities Exchanges	42	Public Health
18	Conservation of Power & Water Resources	43	Public Lands: Interior
19	Customs Duties	44	Emergency Management and Assistance
20	Employees' Benefits	45	Public Welfare
21	Food and Drugs	46	Shipping
22	Foreign Relations	47	Telecommunication
23	Highways	48	Federal Acquisition Regulations System
24	Housing and Urban Development	49	Transportation
25	Indians	50	Wildlife and Fisheries

Table 27. Technology Readiness Levels.

Level	Definition	DoD TRL Description
1	Basic principles observed and reported	Lowest level of technology readiness. Scientific research begins to be translated into applied research and development. Examples might include paper studies of a technology's basic properties.
2	Technology concept and/or application formulated.	Invention begins. Once basic principles are observed, practical applications can be invented. Applications are speculative and there may be no proof or detailed analysis to support the assumptions. Examples are limited to analytic studies.
3	Analytical and experimental critical function and/or characteristic proof of concept.	Active research and development is initiated. This includes analytical studies and laboratory studies to physically validate analytical predictions of separate elements of the technology. Examples include components that are not yet integrated or representative.
4	Component and/or breadboard validation in laboratory environment	Basic technological components are integrated to establish that they will work together. This is relatively "low fidelity" compared to the eventual system. Examples include integration of "ad hoc" hardware in the laboratory.
5	Component and/or breadboard validation in relevant environment.	Fidelity of breadboard technology increases significantly. The basic technological components are integrated with reasonably realistic supporting elements so it can be tested in a simulated environment. Examples include "high fidelity" laboratory integration of components.
6	System/subsystem model or prototype demonstration in a relevant environment.	Representative model or prototype system, which is well beyond that of TRL 5, is tested in a relevant environment. Represents a major step up in a technology's demonstrated readiness. Examples include testing a prototype in a highfidelity laboratory environment or in simulated
7	System prototype demonstration in an operational environment.	Prototype near, or at, planned operational system. Represents a major step up from TRL 6, requiring demonstration of an actual system prototype in an operational environment such as an aircraft, vehicle, or space. Examples include testing the prototype in a test bed aircraft.
8	Actual system completed and qualified through test and demonstration.	Technology has been proven to work in its final form and under expected conditions. In almost all cases, this TRL represnts the end of true system development. Examples include developmental test and evaluation of the system in its intended weapon system to determine if it meets design specifications.
9	Actual system proven through successful mission operations.	Actual application of the technology in its final form and under mission conditions, such as those encountered in operational test and evaluation. Examples include using the system under operational mission conditions.

Table 28. Manufacturing Readiness Levels.

Level	Definition	DoD MRL Description
1	Basic Manufacturing Implications Identified	Basic research expands scientific principles that may have manufacturing implications. The focus is on a high level assessment of manufacturing opportunities. The research is unfettered.
2	Manufacturing Concepts Identified	This level is characterized by describing the application of new manufacturing concepts. Applied research translates basic research into solutions for broadly defined military needs.
3	Manufacturing Proof of Concept Developed	This level begins the validation of the manufacturing concepts through analytical or laboratory experiments. Experimental hardware models have been developed in a laboratory environment that may possess limited functionality.
4	Capability to produce the technology in a laboratory environment	This level of readiness acts as an exit criterion for the MSA Phase approaching a Milestone Adecision. Technologies should have matured to at least TRL 4. This level indicates that the technologies are ready for the Technology Development Phase of acquisition. Producibility assessments of design concepts have been completed. Key design performance parameters have been identified as well as any special tooling, facilities, material handling and skills required.
5	Capability to produce prototype components in a production relevant environment	**Mfg. strategy refined and integrated with Risk Management Plan. Identification of enabling/critical technologies and components is complete. Prototype materials, tooling and test equipment, as well as personnel skills have been demonstrated on components in a production relevant environment, but many manufacturing processes and procedures are still in development.**
6	Capability to produce a prototype system or subsystem in a production relevant environment	This MRL is associated with readiness for a Milestone B decision to initiate an acquisition program by entering into the EMD Phase of acquisition. Technologies should have matured to at least TRL 6. The majority of manufacturing processes have been defined and characterized, but there are still significant engineering and/or design changes in the system itself.
7	Capability to produce systems, subsystems, or components in a production representative environment	System detailed design activity is nearing completion. Material specifications have been approved and materials are available to meet the planned pilot line build schedule. Manufacturing processes and procedures have been demonstrated in a production representative environment. Detailed producibility trade studies are completed and producibility enhancements and risk assessments are underway. Technologies should be on a path to achieve TRL 7.
8	Pilot line capability demonstrated; Ready to begin Low Rate Initial Production	**The system, component or item has been previously produced, is in production, or has successfully achieved low rate initial production. Technologies should have matured to TRL 9. This level of readiness is normally associated with readiness for entry into Full Rate Production (FRP). All systems engineering/design requirements should have been met such that there are minimal system changes. Major system design features are stable and have been proven in test and evaluation.**
9	Low rate production demonstrated; Capability in place to begin Full Rate Production.	The system, component or item has been previously produced, is in production, or has successfully achieved low rate initial production. Technologies should have matured to TRL 9. This level of readiness is normally associated with readiness for entry into Full Rate Production (FRP). All systems engineering/design requirements should have been met such that there are minimal system changes.
10	Full Rate Production demonstrated and lean production practices in place	Technologies should have matured to TRL 9. This level of manufacturing is normally associated with the Production or Sustainment phases of the acquisition life cycle. Engineering/design changes are few and generally limited to quality and cost improvements. System, components or items are in full rate production and meet all engineering, performance, quality and reliability requirements. Manufacturing process capability is at the appropriate quality level.