



University Industry
Demonstration Partnership

The Technology Value Pyramid and related measurement systems used in industrial innovation

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Key Questions Asked of Industrial Research Leaders

- What is the value of the research portfolio?
- When will revenue be realized from R&D investments?
- What is the ROI from R&D expenditures?
- How are these investments aligned with strategy?
- How is the investment being managed?

Key Points

- Project Selection, Project Management / Oversight and Portfolio Management are separate but related issues
- Project Selection → doing the right things
- Project Management → doing things right
- Portfolio Management → Sum of above

Industrial Research Institute Metrics Project(s)

- 1990 – 94 Technology Value Pyramid (TVP)
- 1994 – 96 Technology Value Program
- 1995 – 98 ‘Anchored’ Scales for Projects
- 1998 – 01 ‘Anchored’ Scales for Portfolios
- 1999 – 03 ‘Anchored’ Scales for Front End
- 2005-2011 Updated TVP

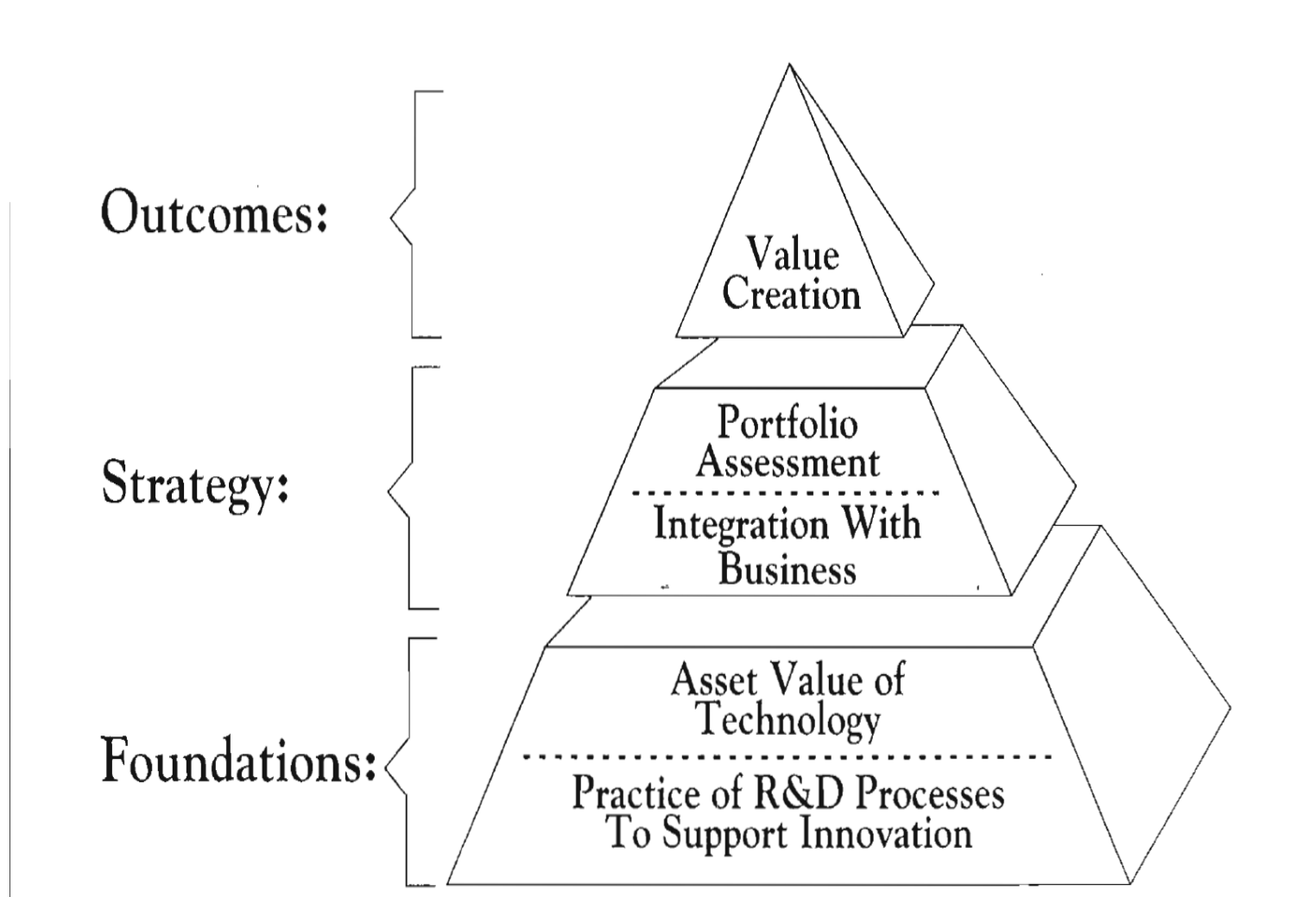


Key Results of Work

- 50 Metrics identified and prioritized
- Framework put in place to organize with Five Hierarchical Layers
 - Value Creation
 - Portfolio Assessment
 - Integration with the Business
 - Asset Value of Technology
 - Practice of R&D Processes
- Can be tailored to context
- Specific metrics selected according to stakeholders / audience



Technology Value Pyramid



Comparison of Most Common Metrics 1994 to 2009

Table 1.—Summary of Survey A results: Top ten metrics in 1994 and 2009

| 1994 | 2009 | |
|--|--|---|
| | For-Profit | Not-For Profit |
| Financial return to the business | Financial return to the business | Strategic alignment with the business |
| Strategic alignment with the business | Strategic alignment with the business | Accomplishment of project milestones |
| Projected value of R&D pipeline | Projected value of R&D pipeline | Quality of R&D personnel |
| Sales or gross profits from new products | Gross profit margin | Portfolio distribution of R&D projects |
| Accomplishment of project milestones | Product quality and reliability | Clarity of project goals |
| Portfolio distribution of R&D projects | Sales or gross profits from new products | Product quality and reliability |
| Market share | Accomplishment of project milestones | Rating of project benefits by customers |
| Customer satisfaction surveys | Achievement of R&D pipeline objectives | External peer evaluation of R&D |
| Development cycle time | Quality of R&D personnel | Customer rating of technical capabilities |
| Gross profit margin | Level of business approval of projects | Number of technical reports |
| Product quality and reliability (tie) | Comparative manufacturing costs (tie) | |

Key Observations 1994 to 2009

Top Metrics That Stayed Same

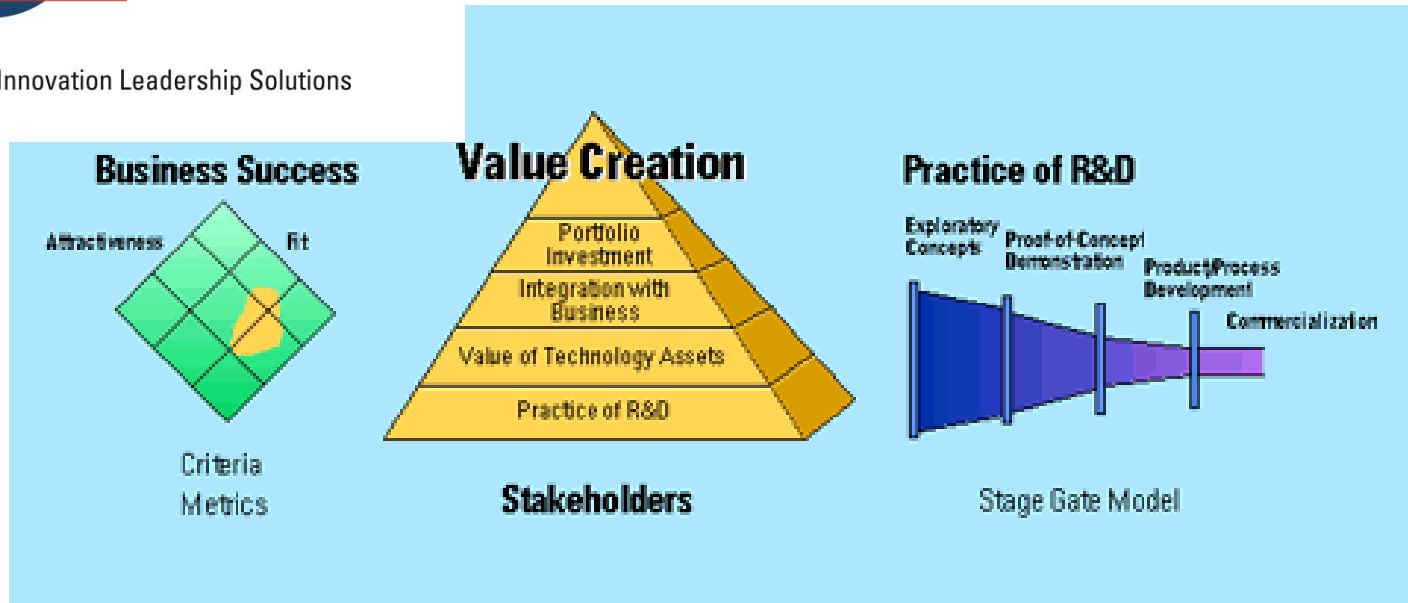
- Financial Return
- Strategic Alignment
- Value of Pipeline
- Gross Profit
- Achievement of Milestones

New Areas in 2009

- Sales or Gross Profit from New Products
- Level of Business Support
- Quality of People



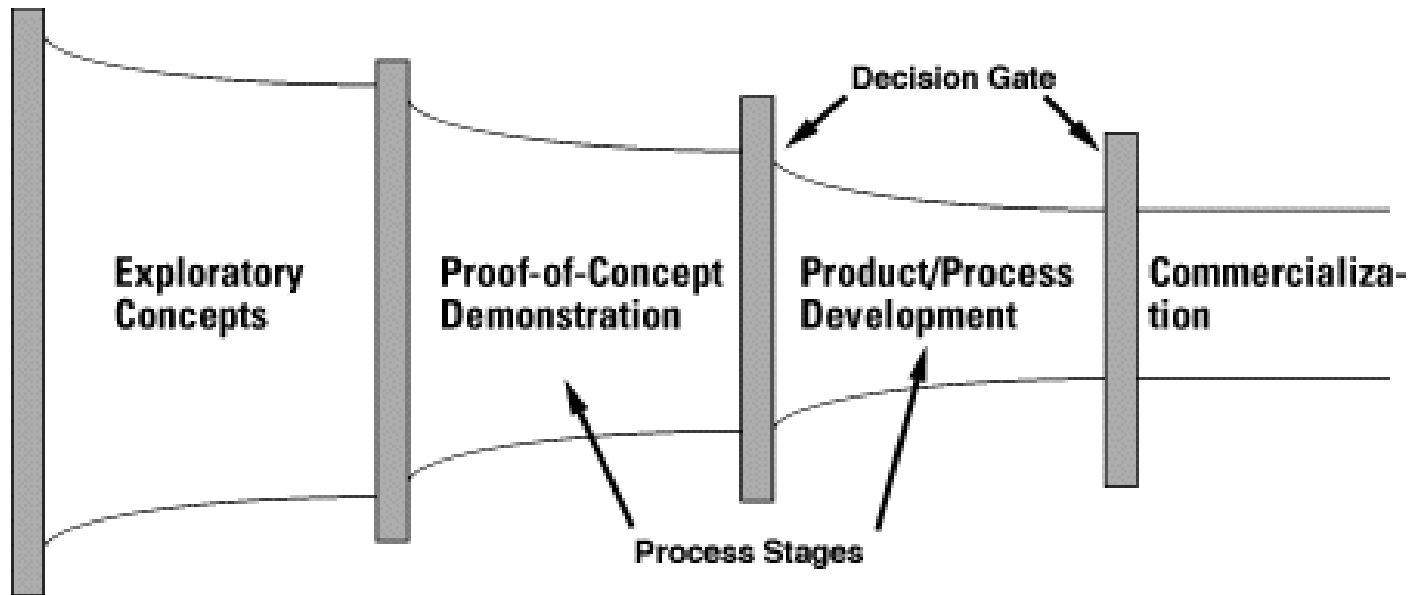
Creating Innovation Leadership Solutions



The TVP program allows you to choose those metrics that best suit the needs you or your organization have,
i.e. choose the metrics (KPI's*) appropriate for the needs at hand.

**KPI = Key performance Indicator*

The Stage-Gate® process is widely used to control the flow of R&D work. The TVP can be effective in selecting metrics at each stage of the Stage-Gate process.



"Stage-Gate® is a registered trademark of Stage Gate Inc"

Stage Gate Concepts

- A number of gated systems exist
- SG is a project management system, not a magic bullet
- Best when accompanied by anchored scales

Positives

- Instills Discipline and Consistency

Negatives

- Perceived as inflexible
- Leads to short cutting or circumventing

Newer Versions of Stage Gate

- Agile (Lean) Stage Gate Hybrids
 - Uses scrum or other iterative techniques on front end
 - Scope and product features are kept open
 - Good for less defined projects
- Abbreviated Stage Gate
 - Reduces stages and gates
 - Good for shorter term or incremental projects

Portfolio Management

More than sum of projects/programs

- Projects by business and type
 - Incremental vs breakthrough
 - Existing product improvement vs new to company vs new to world
- Time horizon
 - Spread across horizons (1-3, 3-5, 5+ years)
- Multiple views
 - Spend, phasing of revenue, key decision dates

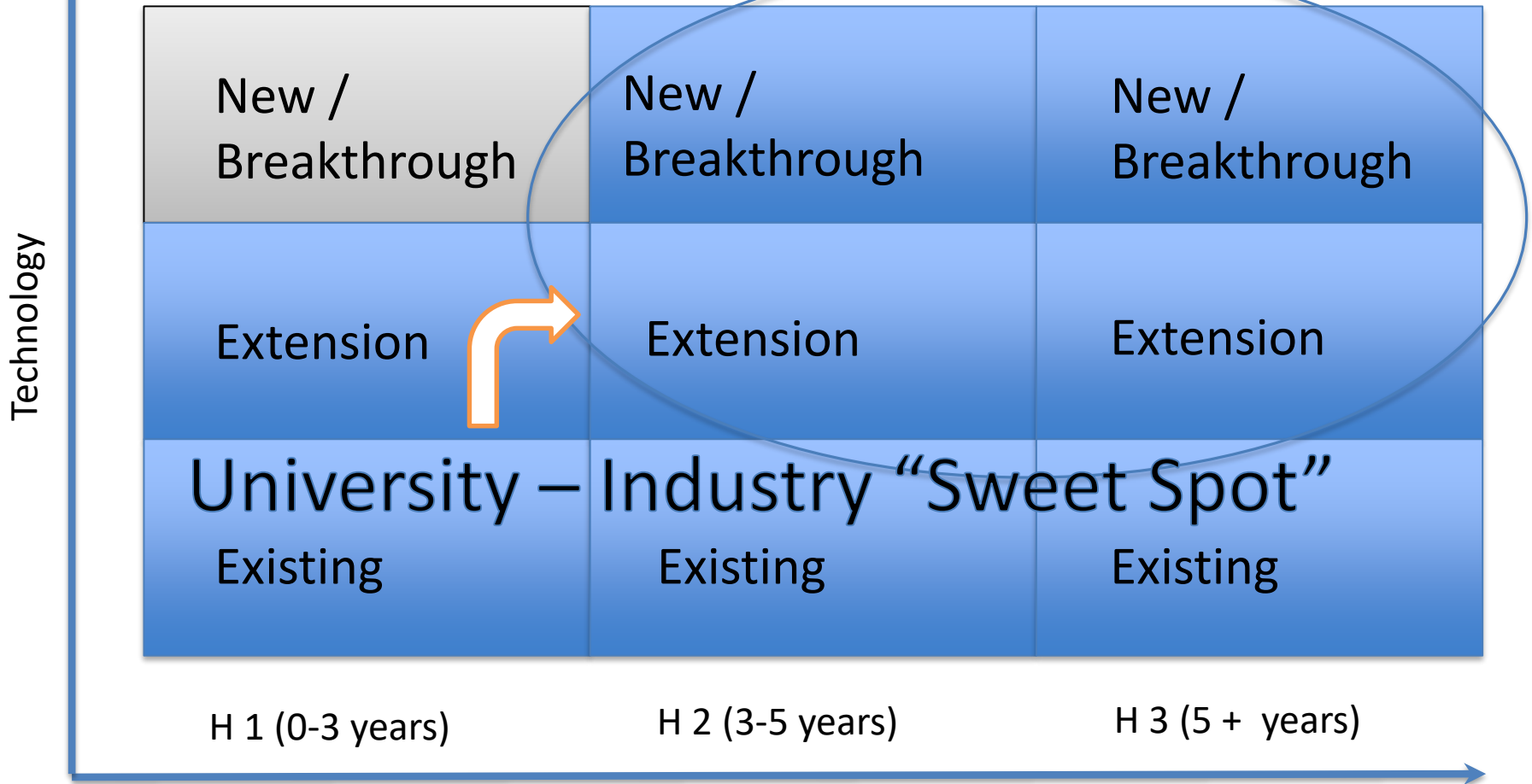
Partnership Implications of Portfolio

View

| | | | |
|--|--------------------|--------------------|--------------------|
| | New / Breakthrough | New / Breakthrough | New / Breakthrough |
| | Extension | Extension | Extension |
| | Existing | Existing | Existing |
| | H 1 (0-3 years) | H 2 (3-5 years) | H 3 (5+ years) |

Time Horizon

Partnership Implications of Portfolio View



One Important Metric - Vitality Index

- Percent of sales due to new products in last 'x years'
 - Typically 4-5 years*
- Criteria of what is 'new' varies*
 - New SKU
 - New to world
 - New to market
 - Next generation
 - Substantive Change

** Source 2017 IRI Survey of IRI Member Companies*

Vitality Index (continued)

- Often cited by companies in investor information and in information related to innovation
- Varies by industry and how define 'New'
- Metric is often criticized but widely used....

Other Common Metrics

- R&D as percent of sales
 - Dependent on industry
 - Crude or ‘coarse’ metric
 - Can be impacted by economies of scale
- External spend
 - Can be good to drive behavior
 - Better metric is projects / new products impacted by external projects

Early Phase / 'Breakthrough' Projects

- Hard numbers for individual projects are unreliable and can lead to sub-optimization
- Softer numbers such as trends and overall market opportunity are often more reliable
- Metrics need to be tuned to audience

Key Points

- Project Selection, Project Management / Oversight and Portfolio Management are separate but related issues
- Project Selection → doing the right things
 - Strategic alignment with financial guidance
- Project Management → doing things right
 - Stage Gate[®] or similar system
- Portfolio Management → Sum of above
 - System for assessing risk, horizon and nature of projects

In Summary....

- TVP is a good formalism to organize thinking around metrics
- Interrelated issues such as project and portfolio management need to be considered in establishing system
- No system is perfect. Benefit can be gained from starting and learning as you go
- Understanding partners' metrics and measures can provide insight into rewards and motivation

Back – up information

5 Generations of Stage-Gate®

| | Stage-Gate® 1st Generation | Stage-Gate® 2nd Generation | Stage-Gate® 3rd Generation | Stage-Gate® 4th Generation | Beyond Stage- Gate® |
|---------------|--|--|---|--|--|
| Over- view | | | | | |
| Stages | <ul style="list-style-type: none"> Standardizing the activities of each stage Focus on development stage | <ul style="list-style-type: none"> Rigid Stages Parallelizing the activities within the Stages | <ul style="list-style-type: none"> Overlapping, flexible Stages Idea Generation | <ul style="list-style-type: none"> Elements of Lean within the Stages Spiral Development | <ul style="list-style-type: none"> Context-based models Project Canvas Agile – time-boxed sprints & scrums Earlier customer iterations/tests with prototypes |
| Gates | <ul style="list-style-type: none"> Go-Kill Stage-Reviews | <ul style="list-style-type: none"> Gate criteria The Gate opens the next Stage Post Launch Review | <ul style="list-style-type: none"> Defined Deliverables for each Gate | <ul style="list-style-type: none"> Gates with teeth | <ul style="list-style-type: none"> Resources committed at gates Empowerment to project teams |
| Focus on | <ul style="list-style-type: none"> System to ensure that the projects stay in time and budget | <ul style="list-style-type: none"> Early „homework“ phases (Stage 1 und 2) | <ul style="list-style-type: none"> Funnel no tunnel Different process types Voice-of-Customer Portfolio-Mgt | <ul style="list-style-type: none"> Radical Innovation instead of minor improvements Innovation Culture | <ul style="list-style-type: none"> Cope with unknowns & uncertainties Validate assumptions, reduce unknowns Mitigate risk of highly innovative projects |
| Proj. Mgt | <ul style="list-style-type: none"> R&D focused teams Project responsibility on Project Leader | <ul style="list-style-type: none"> X-functional teams Project responsibility on Project Leader | <ul style="list-style-type: none"> X-functional teams More responsibility on entire project team | <ul style="list-style-type: none"> X-functional teams More responsibility on project team than on PL | <ul style="list-style-type: none"> Dedicated X-functional teams More responsibility on project team than on Project Leader |

Next Generation Stage Gate

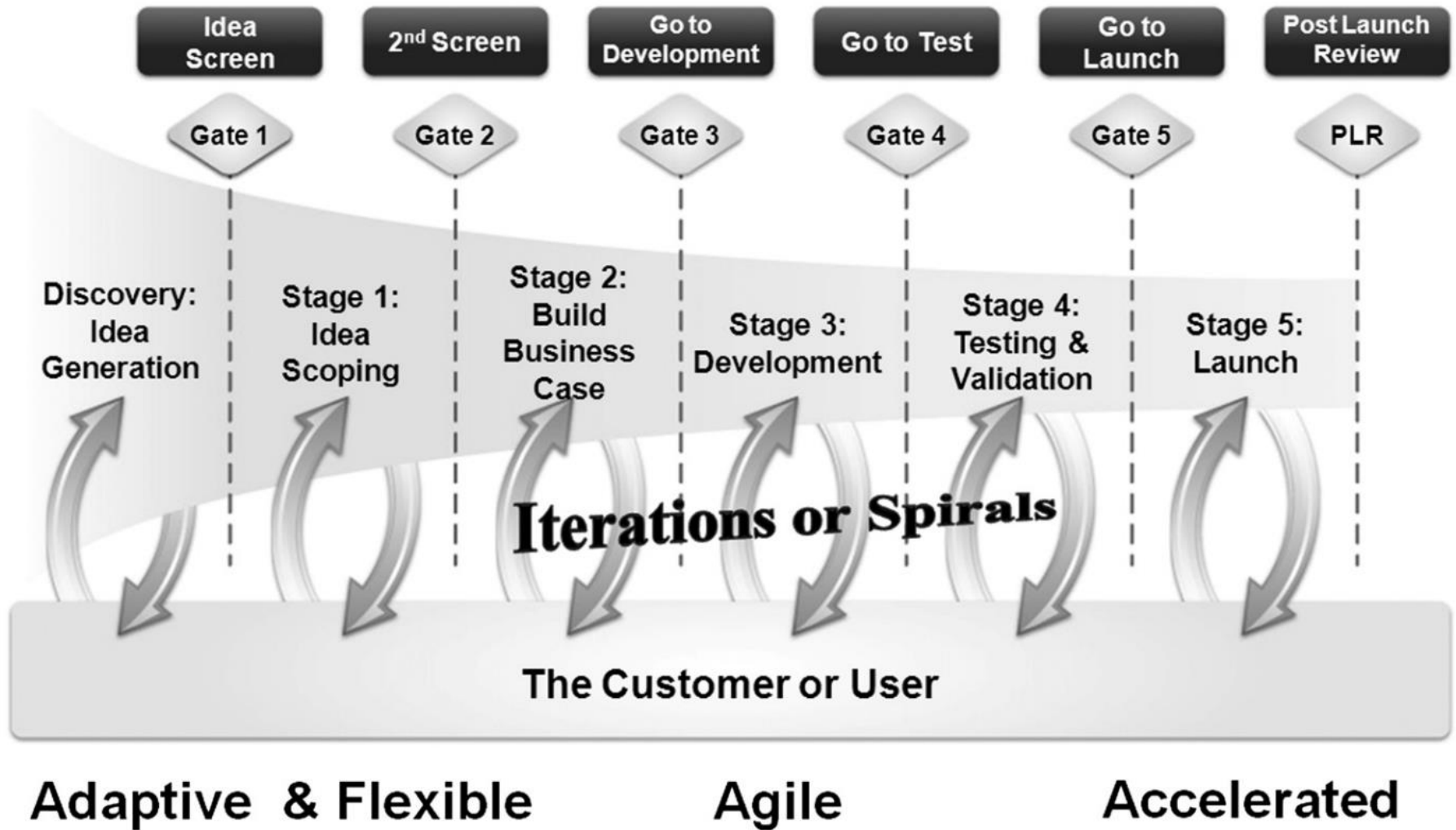


FIGURE 1. The next-generation idea-to-launch system

Representative References

TVP –

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Lawrence Schwartz, Roger Miller, Daniel Plummer & Alan R. Fusfeld (2011) 'Measuring the Effectiveness of R&D', *Research-Technology Management*, 54:5, 29-36

Stage Gate-

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