

# Customer Interaction and Collaboration in Industrial Product Development: Creating Superior Products

Second Paper by:  
Jeffrey S. Pinegar  
October 17, 2003

# Agenda

- Scope, Motivation and Research Questions
- Research Design and Methodology
- Customer Interaction and Collaboration (CIC)
- CIC Framework
  - CIC
  - Market Orientation
  - Relationship Commitment and Trust
  - NPD Success & Product Advantage
  - Product Impact on the Customer (Customer Relevance)
  - OEM Knowledge Gap
- Future Research

# Scope

- Industrial New Product Development
  - Manufactured materials, parts and capital items purchased for further processing, or for use in conducting business
  - Excludes services
  - Excludes consumer products based on use  
*(Kotler & Armstrong, 1997)*
- Customer  $\square$  OEM Relationships
  - During the development of new products
  - This is not customer Involvement from a consumer behavior perspective, i.e. consumers becoming involve with product before a purchase.

# Motivation

- Over 10,000 new products are market every year in the United States alone (Crawford, 1997)
- 35%-40% of all products launched into the market fail
- 46% of NPD spending is on products that fail or are cancelled (Booz, Allen & Hamilton, 1982)
- Successful products are crucial to business success through the creation of sustainable competitive advantage (Porter, 1985)
- “A dominate success factor is having an unbeatable product: a superior product ...” (Cooper, 1998)

## Motivation (cont.)

- The customer is critical to product development
  - The customer is integral with many business strategies
    - Market-driven Strategy
    - Customer-focused Strategy (Deshpande, 1999)
  - Successful innovation and new product creation must meet the needs and satisfy the wants of the customer (Cooper, 1998; Drucker, 1954; Wheelwright & Clark, 1995)

## Motivation (cont.)

- Customer interaction afforded by the internet and e-commerce increase pressure for product mass customization (Peppers, Rogers, & Dorf, 1999; Prahalad & Ramaswamy, 2000; Slywotzky, 2000)

## Motivation (cont.)

- Other research suggests that customers can be risk-adverse and not eager for new product innovations, thereby inhibiting the development process (Souder 1987)
- Customers inhibit organization innovation and their ability to develop break through products (Bennett & Cooper, 1979; Christensen & Bower, 1996; Hamel and Prahalad, 1994)

## Motivation (cont.)

- The role of the customer in product development has generally been neglected. Some exceptions:
  - von Hippel's work on Lead-User-Analysis (1976, 1984, 1988)
  - Griffin & Hauser's work on the Voice of the Customer (1993)

## Research Questions

- Is customer Interaction and collaboration always preferred?
- What are the antecedents to CIC?
- What should be the role of the customer in new product development?
- How will customer interaction and collaboration in new product development transform the process and the products?

## Customer Interaction and Collaboration (CIC) is defined as:

*the interaction and/or collaboration between channel members (including customers and users) and company personnel during the course of product development to actualize a commercial product.*

## CIC in NPD

- Active engagement in the process of product development with the developing company
- An exchange between the potential customer and the people of the developing organization

	Interaction	Collaboration
Relationships	Transactions	Continuous
Structure	Formal	Informal
Dependency	Independent	Interdependent
Environment	Competitive	Cooperative
Mechanisms	Communication	Shared vision, collective goals
Metric	Cost per transaction	Opportunity gain

# Customer Led or Market Oriented

	Customer Led	Market Oriented
<b>Strategic Orientation</b>	<b>Expressed Wants</b>	<b>Latent Needs</b>
<b>Adjustment Style</b>	<b>Responsive</b>	<b>Proactive</b>
<b>Time Horizon Focus</b>	<b>Short-Term</b>	<b>Long-Range</b>
<b>Objective</b>	<b>Customer Satisfaction</b>	<b>Customer Value</b>
<b>Learning Processes</b>	<b>Customer Survey</b>	<b>Customer Observation</b>
	<b>Key Account Relationship</b>	<b>Lead user Relationships</b>
	<b>Focus Groups</b>	<b>Continuous Experimentation</b>
	<b>Concept Testing</b>	<b>Selective Partnering</b>

Slater & Narver (1998)

# Customer Vs. Supplier Interaction or Collaboration <sup>13</sup>

## Customer

- What to build
- What should be built
- Benefits and Functions
- What needs to be
- Plan

## Supplier

- How to build
- What could be built
- Form and Features
- What can be
- Implement

# Agenda

- Scope, Motivation and Research Questions
- ➔ • Research Design and Methodology
- Customer Interaction and Collaboration (CIC)
- CIC Framework
  - CIC
  - Market Orientation
  - Relationship Commitment and Trust
  - NPD Success & Product Advantage
  - Product Impact on the Customer (Customer Relevance)
  - OEM Knowledge Gap
- Future Research

# Research Design and Methodology

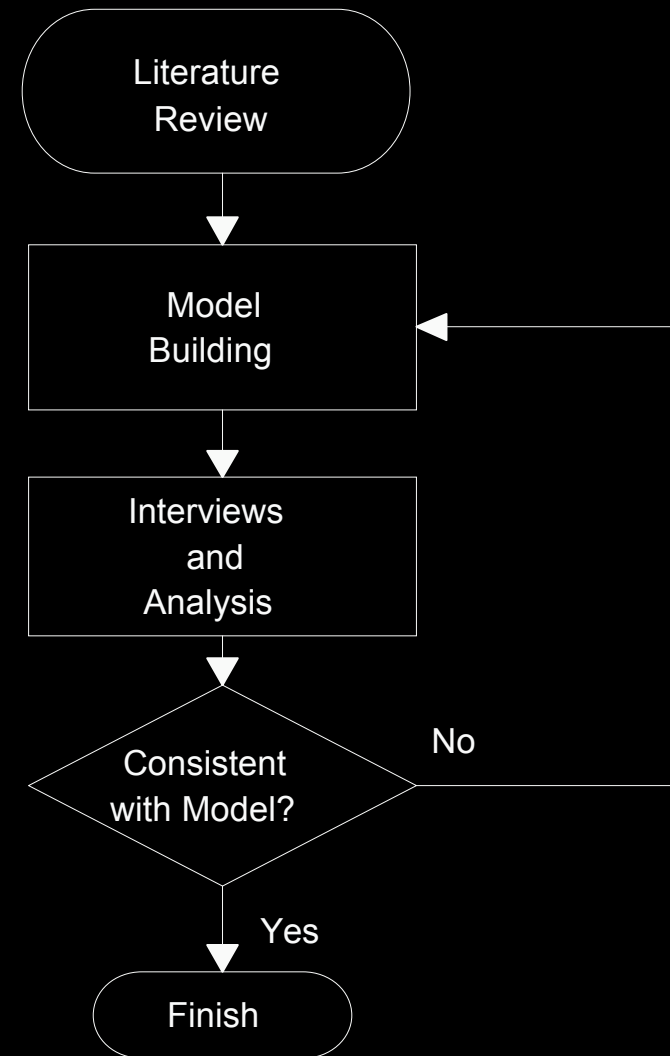
Empirical Path: Theory Generation

Grounded Theory Generation

Qualitative  
Interviews

# Steps in the Process

1. Literature review
2. First round of interviews, intertwined with analysis
3. Preliminary Model building
4. Second round of interviews, intertwined with analysis.



# Sample

- 16 interviews with 13 unique respondents from 10 companies, in 7 industries
- Sampling
  - Product Development Management Association
  - Screener Survey
    - 1000 invitation via e-newsletter
    - Interview opt-in
  - Referrals

# Summary of Interviews

Ref	Industry	Number of Interviews
1, 2	Building Products	3
3, 7	Specialty Machinery	2
4	Agricultural Equipment	4
5, 10	Automation Equipment	4
6	Electronics Equipment	1
8	Medical Equipment	1
9	Consumer Packaged Goods	1
	Total of 16 interviews in 7 - Industries	16

# #3

- **Interviewee:**
  - Owner/Operations Manager
- **Company Overview:**
  - Company #3 specializes in the design, manufacturing, installation and service of packaging and processing solutions for a variety of industries. □ Company #3 produces prototypes, one-of-a-kind □ items or multiple production line items.
  - While they work in a number of industry segments, their primary focus has been within the poultry and fresh meat industries providing solutions to their unique product and material handling needs. □ The design of a machine for this market was the focus of the interview. Their market is across the United States and throughout the world, providing solutions to a majority of the big names in the packaging industry. □

## Interview Clip - Why CIC? - Carrots

- Machine builder cuts 1 year off development as the result of CIC.
- Reduces number of iteration to achieve a standardized product



## Interview Clip - Why CIC? - Sticks

- Wasted Money
- Commercial Failure



# #4

- **Interviewees:**
  - Director of Market Research (2x)
  - Director of Global Marketing (2x)
- **Company Overview:**
  - Company #4 is the number one manufacturer of agricultural tractors and combines in the world, the third largest maker of construction equipment.
  - Revenues in 2002 totaled \$10 billion. Based in the United States, company #4 has network of dealers and distributors operates in over 160 countries. Products are sold under a approximately 9 major brand names. The focus of our the interviews with company #4 were around the agricultural business and the development of new tractor platforms.

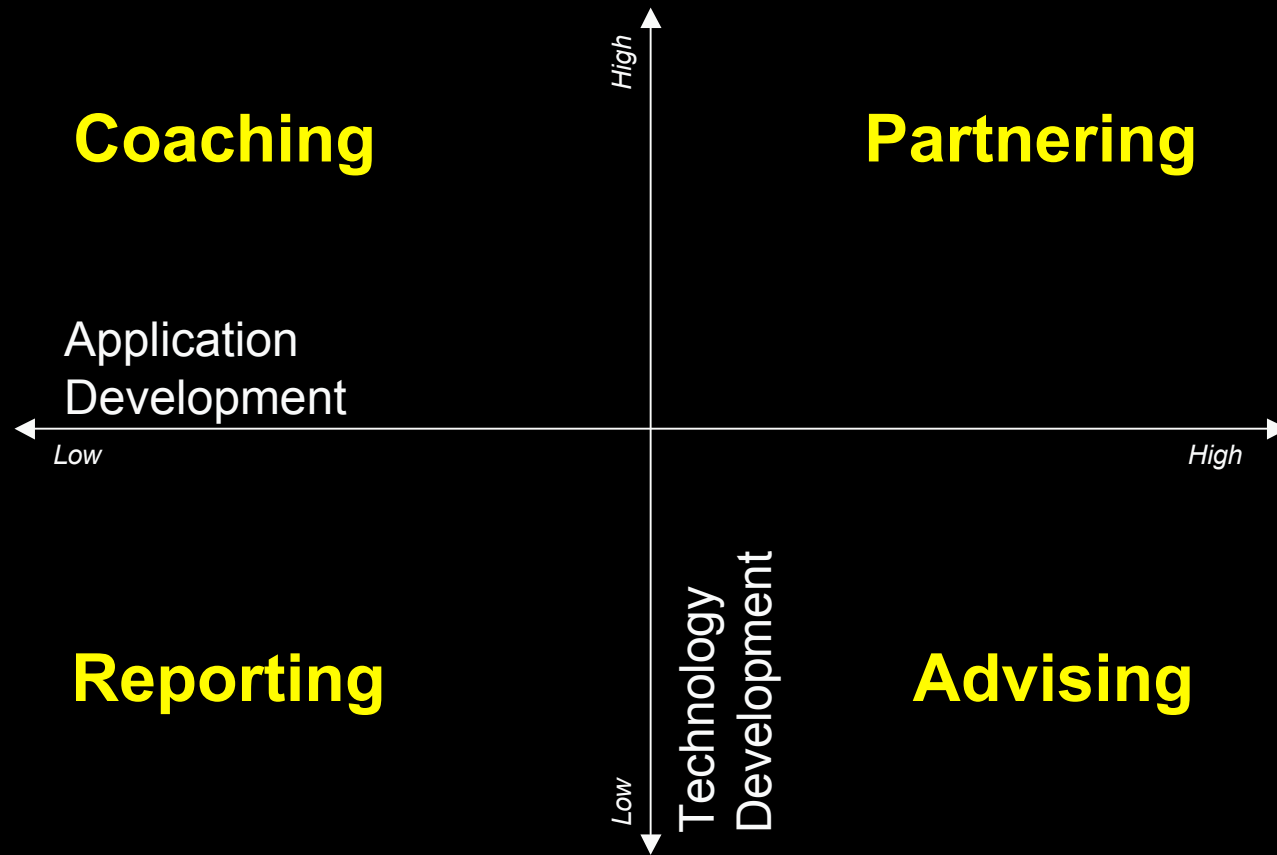
# #5

- **Interviewee:**
  - Marketing Manager
- **Company Overview:**
  - Company #5 is a leading global manufacturer of industrial belting, power transmission and motion control components. Recognized widely for our expertise in manufacturing technology. The company is comprised of two divisions, focusing on precision products and industrial products.
  - Precision products include precision timing and multi-V belts, pulleys, tires, and coated fabric for manufacturers of small mechanisms. Industrial products include link V-belts, keyless bushings, urethane belting, composite pulleys, and tensioners for mechanical power transmission, motion control and conveying. The interview focused on the development of a new v-belt technology platform

# Agenda

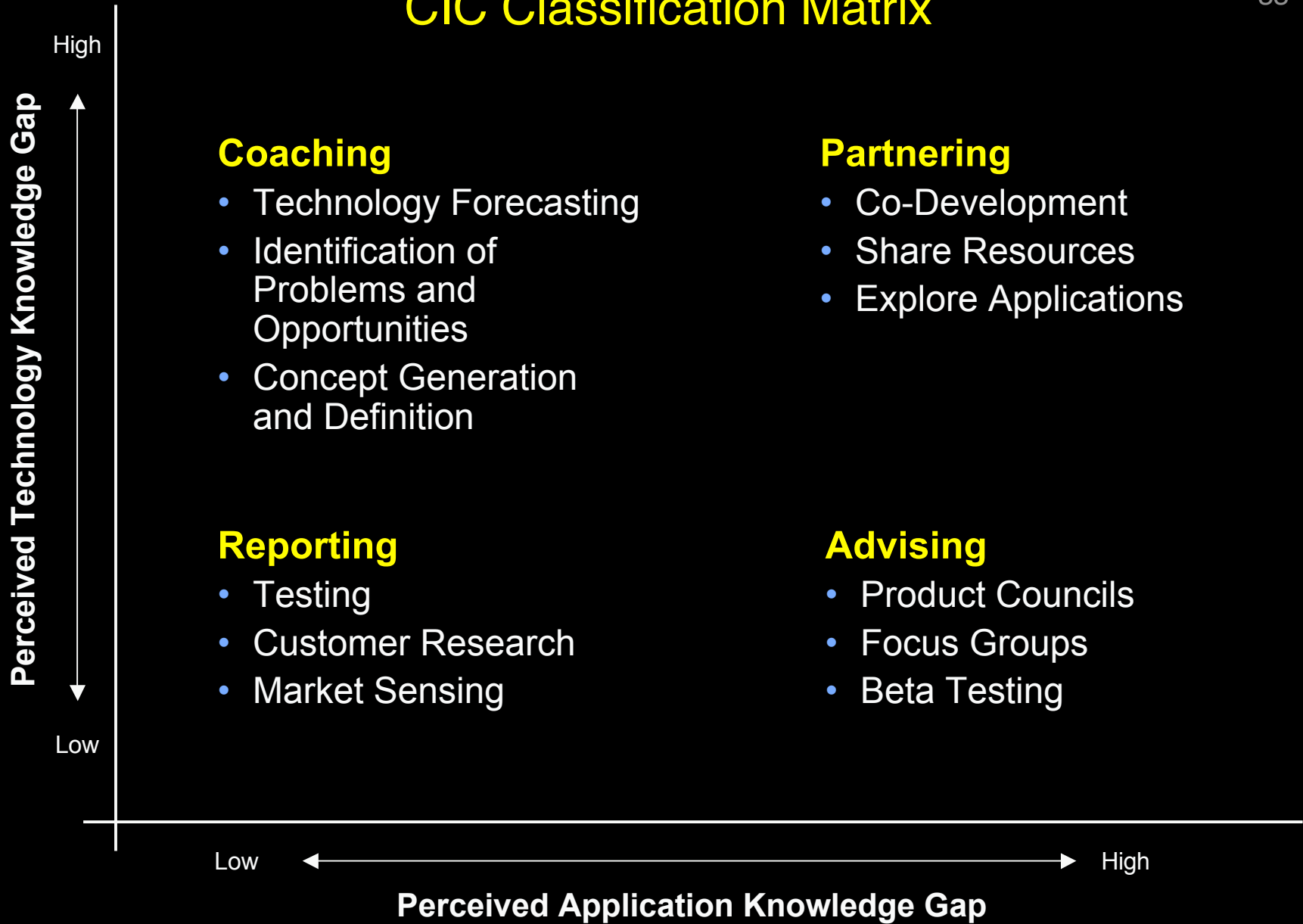
- Scope, Motivation and Research Questions
- Research Design and Methodology
- • Customer Interaction and Collaboration (CIC)
- CIC Framework
  - CIC
  - Market Orientation
  - Relationship Commitment and Trust
  - NPD Success & Product Advantage
  - Product Impact on the Customer (Customer Relevance)
  - OEM Knowledge Gap
- Future Research

# Customer Involvement Matrix

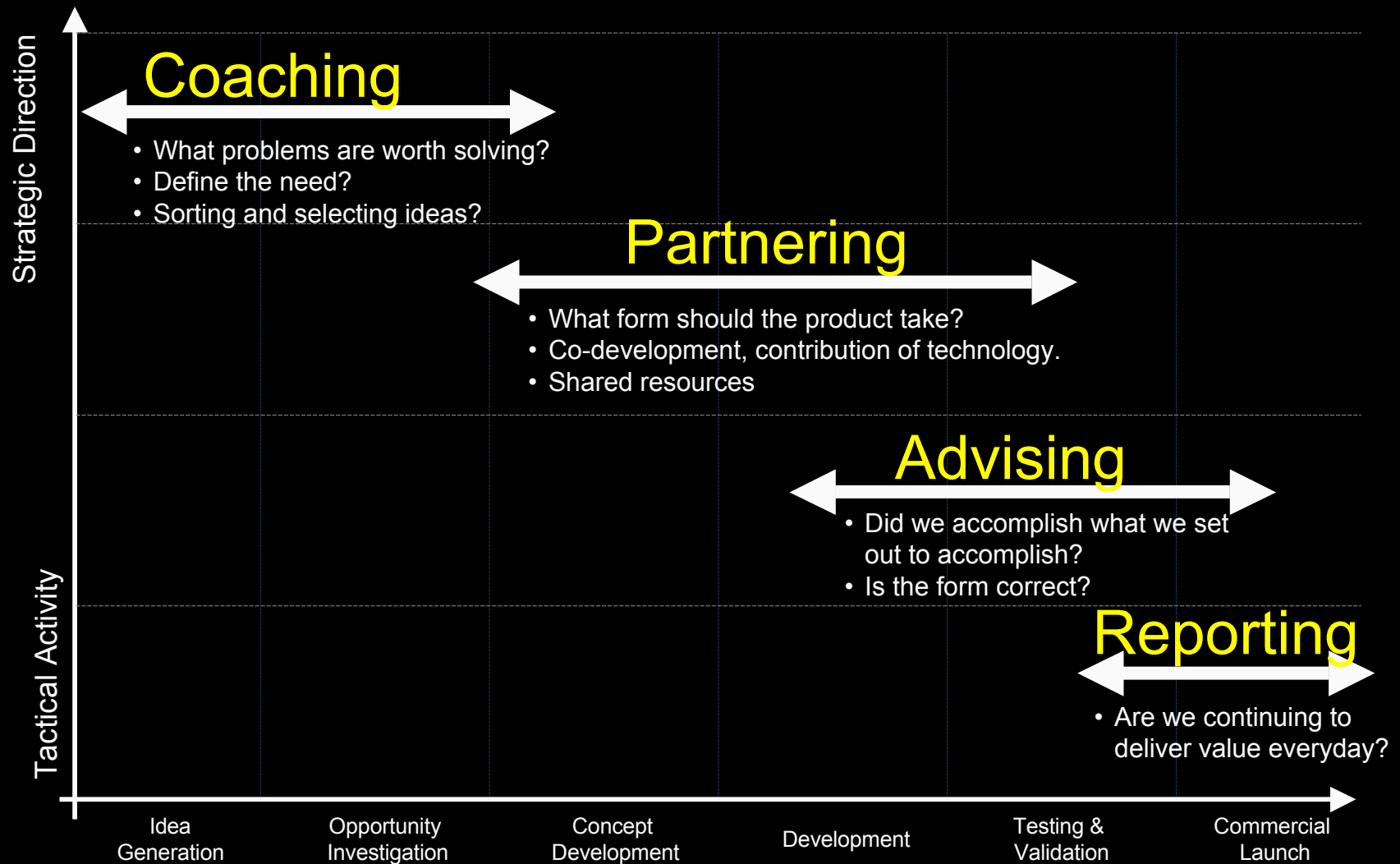


# CIC Classification Matrix

33



# Customer Interaction and Collaboration in NPD



# Idea Generation

- Describe needs and wants
- Suggest desired features
- Forecasting technology
- Identify benefits, attributes and preference
- Identify problems not solved by existing products
- Identify opportunities for new products
- Evaluate existing products suggesting likes and dislikes and identifying defects and deficiencies
- Identify gaps in the market
- Provide a wish list of product requirements

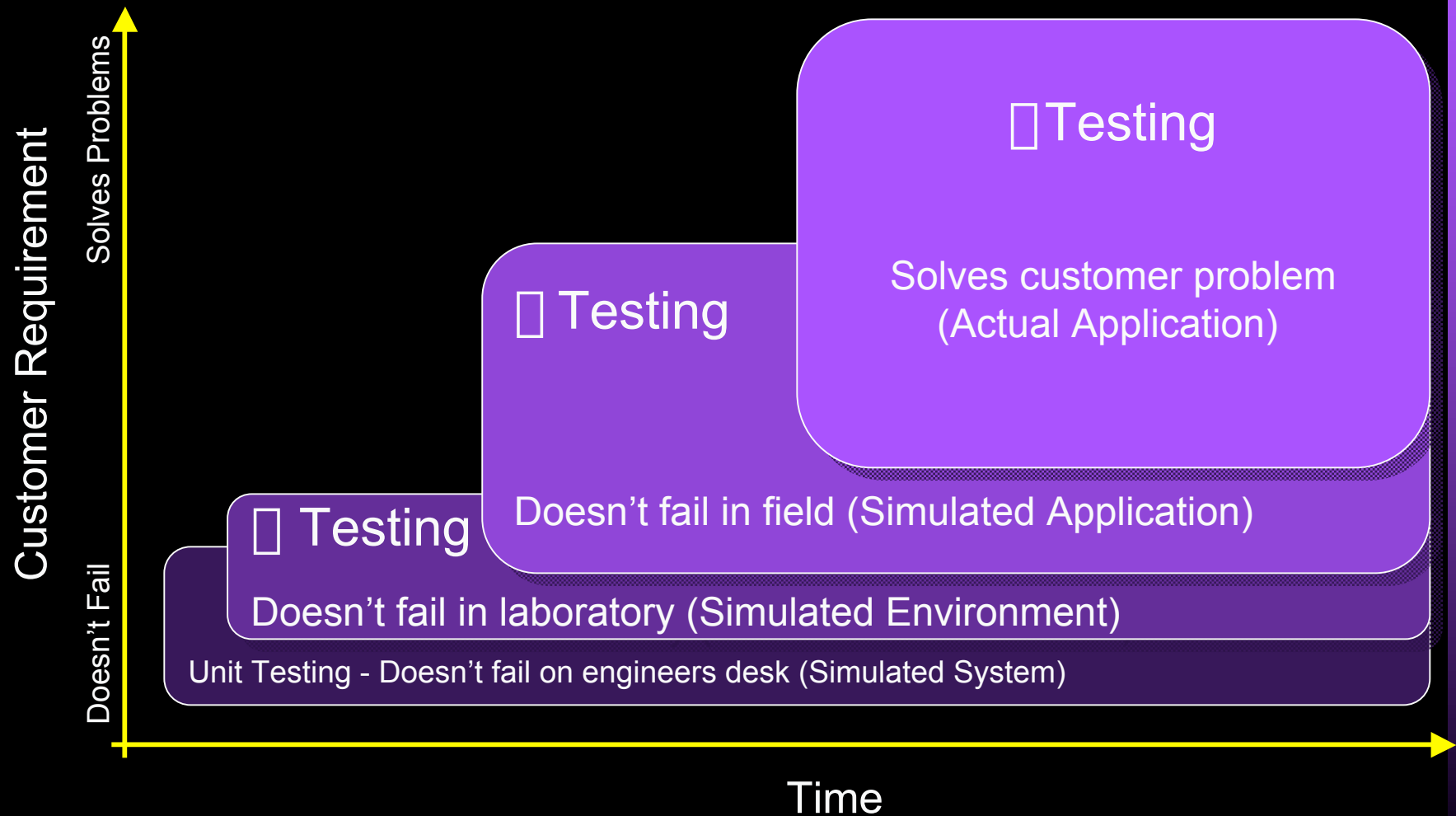
# Development

- Join NPD team to contribute technology and application expertise; explore possible applications; engage in joint problem solving; and shared resources
- Review or jointly develop the overall design and configurations; compare their wish lists with the proposed design of the product
- Test/evaluated prototypes and subsystems as they are developed and suggest improvements by identifying a product's weak/fail points
- Provide a realistic product use environment
- Evaluation of proposed interface between the product and the user

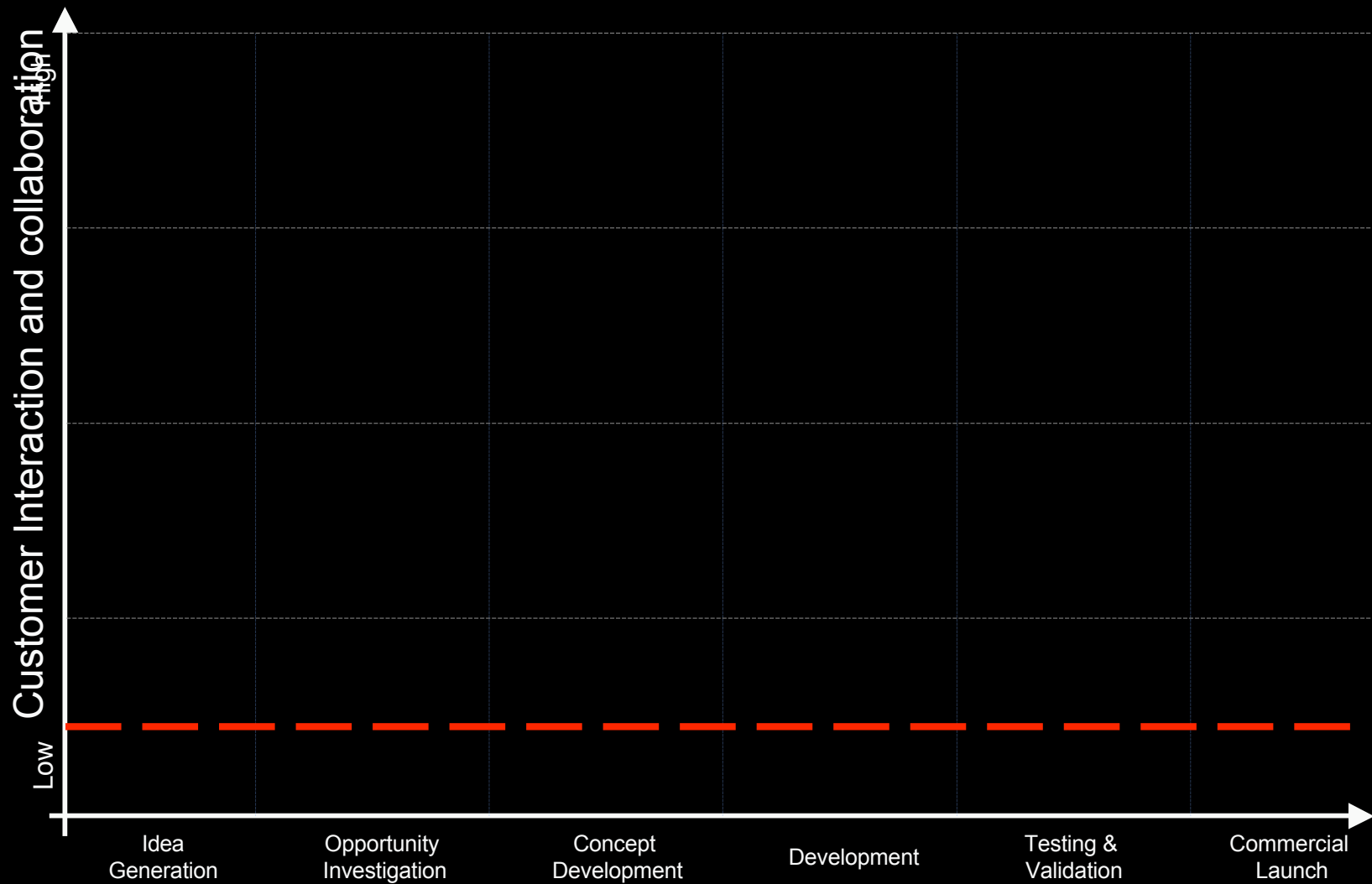
# Testing and Validation

- Test the working prototypes by critiquing their functionality, reliability and performance
- Participate in mock product use situation and suggest improvements
- Rate the overall customers' acceptance of the product

# Test and Validation - Types of Testing

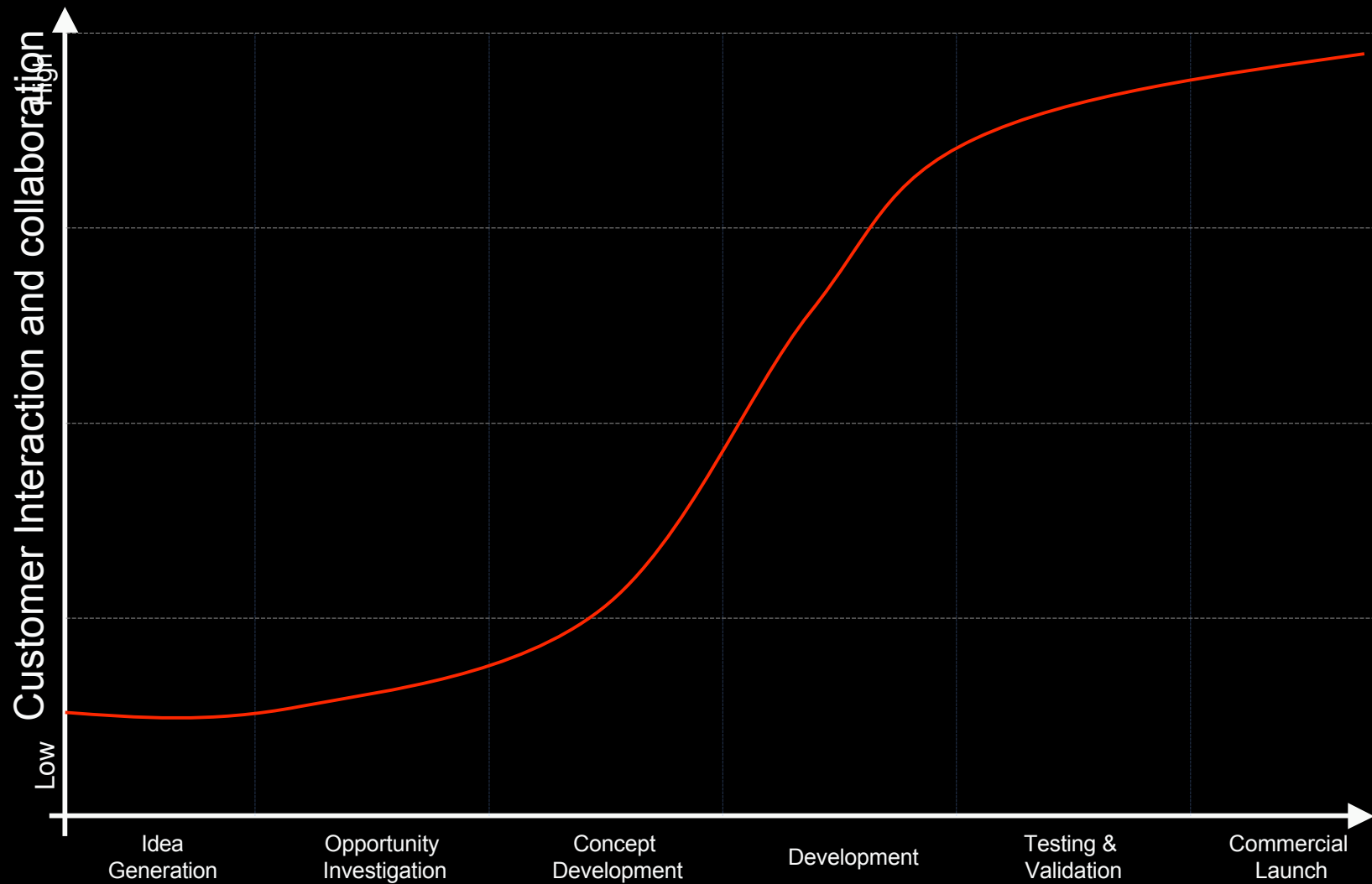


# Cost Reduction or minor modification - Product Development <sup>47</sup>

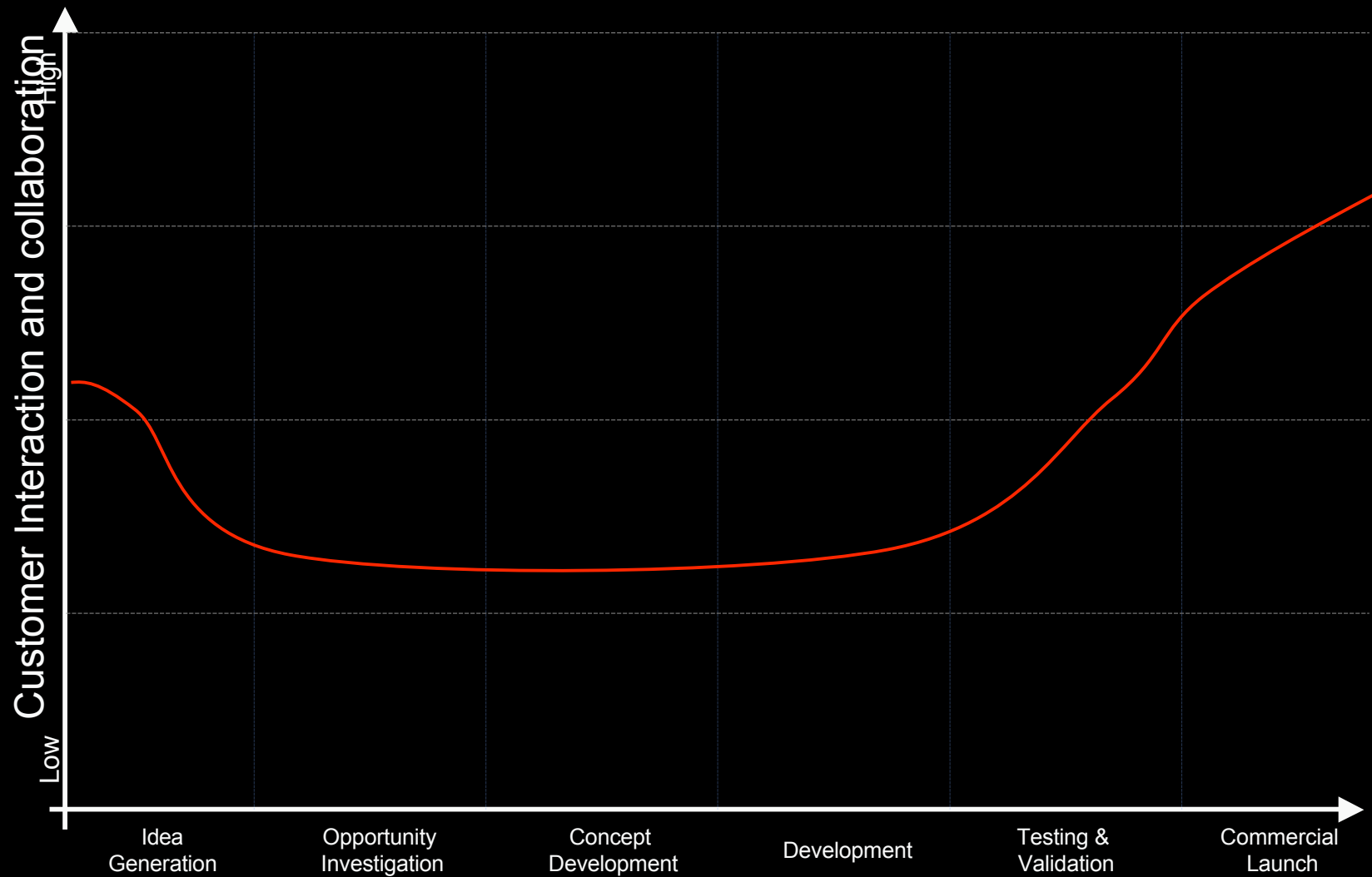


# New -to-the-World Product Development

48



# New item in an existing product line - Product Development<sup>49</sup>



	<b>Coaching</b>	<b>Partnering</b>	<b>Advising</b>	<b>Reporting</b>
<i>Type of Innovation</i>	<i>Discontinuous Innovation</i>		<i>Incremental Innovation</i>	
<i>OEM Commercialization Focus</i>	<ul style="list-style-type: none"> <li>• Conceive</li> <li>• Plan</li> </ul>	<ul style="list-style-type: none"> <li>• Development</li> <li>• Prototyping</li> <li>• Launch</li> </ul>	<ul style="list-style-type: none"> <li>• Market Acceptance</li> <li>• Market growth</li> </ul>	<ul style="list-style-type: none"> <li>• Maintenance</li> <li>• Market Expansion</li> </ul>
<i>OEM Offering to the Customer</i>	<ul style="list-style-type: none"> <li>• Learning Forum</li> </ul>	<ul style="list-style-type: none"> <li>• Technology Form Expertise</li> </ul>	<ul style="list-style-type: none"> <li>• Key Access to OEM</li> </ul>	<ul style="list-style-type: none"> <li>• Responsiveness to Customer Feedback</li> </ul>
<i>OEM's Motivation to Involve Customers</i>	<ul style="list-style-type: none"> <li>• Opportunity Identification</li> <li>• Idea Generation</li> <li>• Clarity of Problem Definition</li> </ul>	<ul style="list-style-type: none"> <li>• Product Integrity</li> <li>• Technology Application Fusion</li> <li>• Establish a Beachhead</li> </ul>	<ul style="list-style-type: none"> <li>• Complete Product Platform</li> <li>• Market Expansion</li> <li>• Strengthen Channel Presence</li> </ul>	<ul style="list-style-type: none"> <li>• Market Sensing</li> <li>• Product Fine Tuning</li> </ul>
<i>Customer Participants</i>	<ul style="list-style-type: none"> <li>• Key Experts</li> <li>• Opinion Leaders</li> <li>• Technology Enthusiasts</li> </ul>	<ul style="list-style-type: none"> <li>• Lead Users</li> <li>• Visionaries</li> </ul>	<ul style="list-style-type: none"> <li>• Early Majority Customers</li> <li>• Channel Partners</li> </ul>	<ul style="list-style-type: none"> <li>• Customers</li> <li>• Non-customers</li> </ul>
<i>Customer Offering to the OEM</i>	<ul style="list-style-type: none"> <li>• Technology Forecasting, Seeding of Ideas</li> </ul>	<ul style="list-style-type: none"> <li>• Technology Application Expertise</li> </ul>	<ul style="list-style-type: none"> <li>• Direction</li> </ul>	<ul style="list-style-type: none"> <li>• Feedback</li> </ul>
<i>Customer's Motivation to Work with OEM</i>	<ul style="list-style-type: none"> <li>• Learning Opportunity</li> <li>• Affiliation with OEM</li> <li>• Curiosity</li> </ul>	<ul style="list-style-type: none"> <li>• Competitive Advantage</li> <li>• Dramatic Performance Increase</li> <li>• Technology Application Exclusivity</li> </ul>	<ul style="list-style-type: none"> <li>• Influence Direction of OEM</li> <li>• Increase Customer Value</li> <li>• Augment/Complete Solution</li> <li>• Expand Solution Opportunities</li> </ul>	<ul style="list-style-type: none"> <li>• Ability to Voice Opinion</li> <li>• Product Enhancements</li> </ul>
<i>Collective Activities Between OEM and Customer</i>	<ul style="list-style-type: none"> <li>• Technology Forecasting</li> <li>• Identification of Problems and Opportunities</li> <li>• Concept Generation and Definition</li> </ul>	<ul style="list-style-type: none"> <li>• Evaluate Implementation Choices</li> <li>• Explore Possible Applications</li> <li>• Co-Development</li> <li>• Joint Problem Solving</li> <li>• Shared resources</li> <li>• Prototype Testing</li> </ul>	<ul style="list-style-type: none"> <li>• Product Councils</li> <li>• Problem/Opportunity Identification</li> <li>• Beta Testing</li> </ul>	<ul style="list-style-type: none"> <li>• Market Testing</li> <li>• Customer Research</li> </ul>
<i>Challenges Facing the OEM-Customer Relationship</i>	<ul style="list-style-type: none"> <li>• Scope Creep</li> <li>• Privacy</li> </ul>	<ul style="list-style-type: none"> <li>• Complexity of Relationship</li> <li>• Relationship Commitments</li> <li>• Intellectual Property Rights</li> <li>• "Not Invented Here" Attitude</li> <li>• Finding the Right Partner</li> </ul>	<ul style="list-style-type: none"> <li>• Multiple Firm Dynamics</li> <li>• Group Think</li> <li>• Impact vs. Value</li> </ul>	<ul style="list-style-type: none"> <li>• Overconfidence</li> <li>• Apathy</li> <li>• Biased Opinions</li> </ul>

## Interview Clip - Who do you involve?

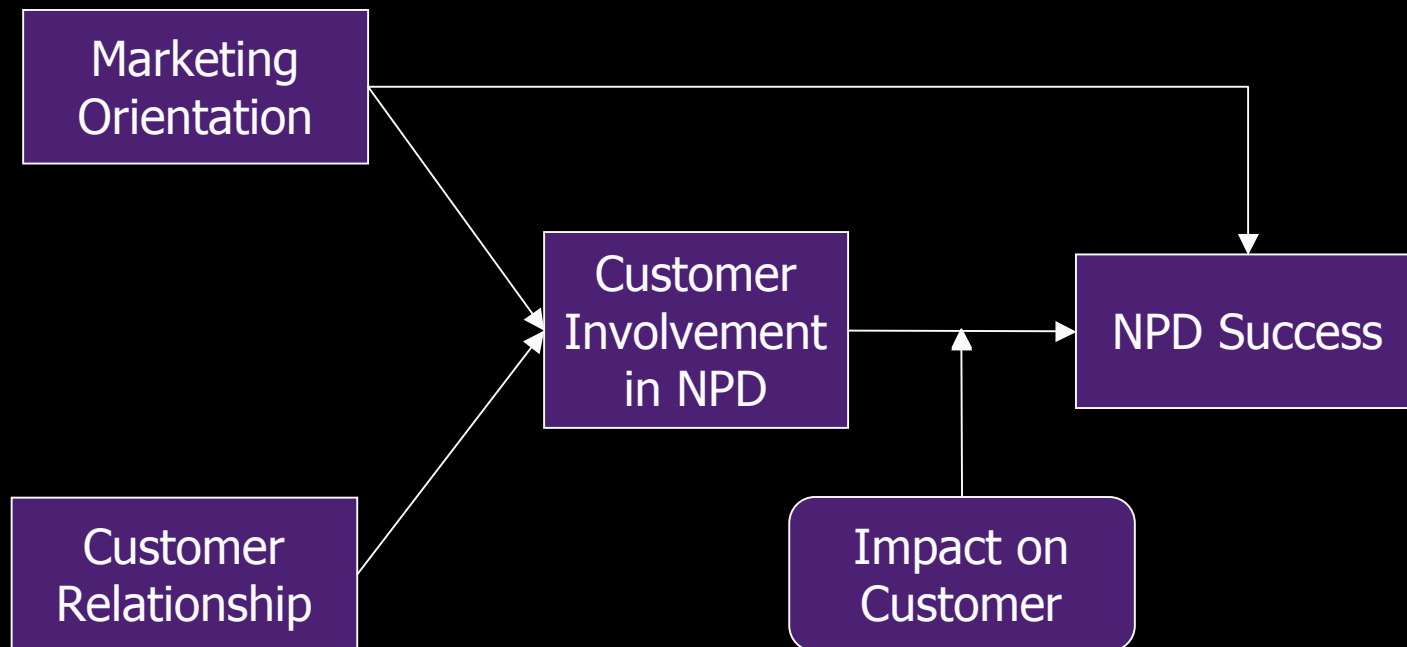
- Thought leaders
  - Innovators
  - Lead users
- End Users
  - What do they need
  - What are their problems
  - What recommendation for improving the product do they have?



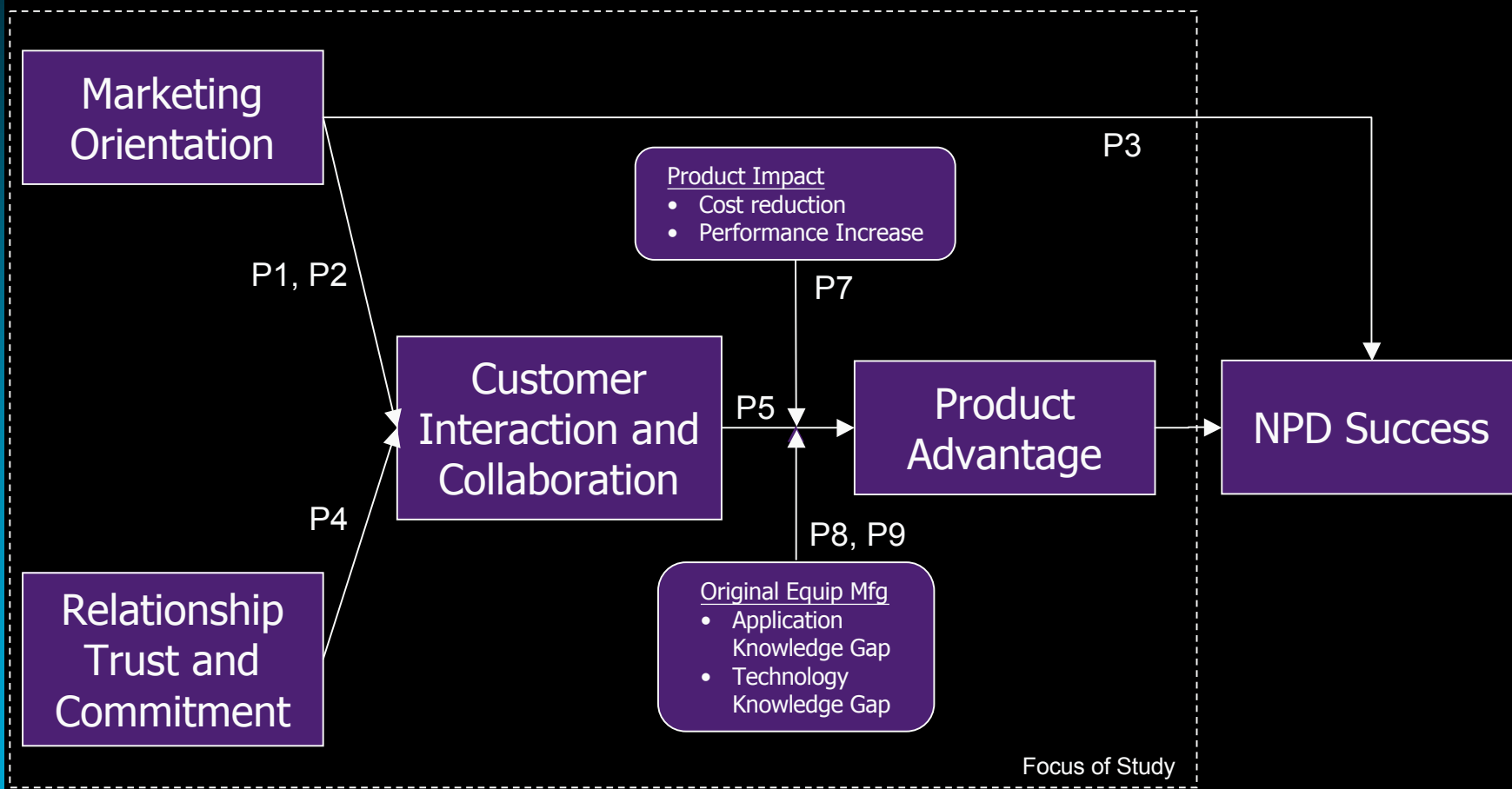
# Agenda

- Scope, Motivation and Research Questions
- Research Design and Methodology
- Customer Interaction and Collaboration (CIC)
- • CIC Framework
  - CIC
  - Market Orientation
  - Relationship Commitment and Trust
  - NPD Success & Product Advantage
  - Product Impact on the Customer (Customer Relevance)
  - OEM Knowledge Gap
- Future Research

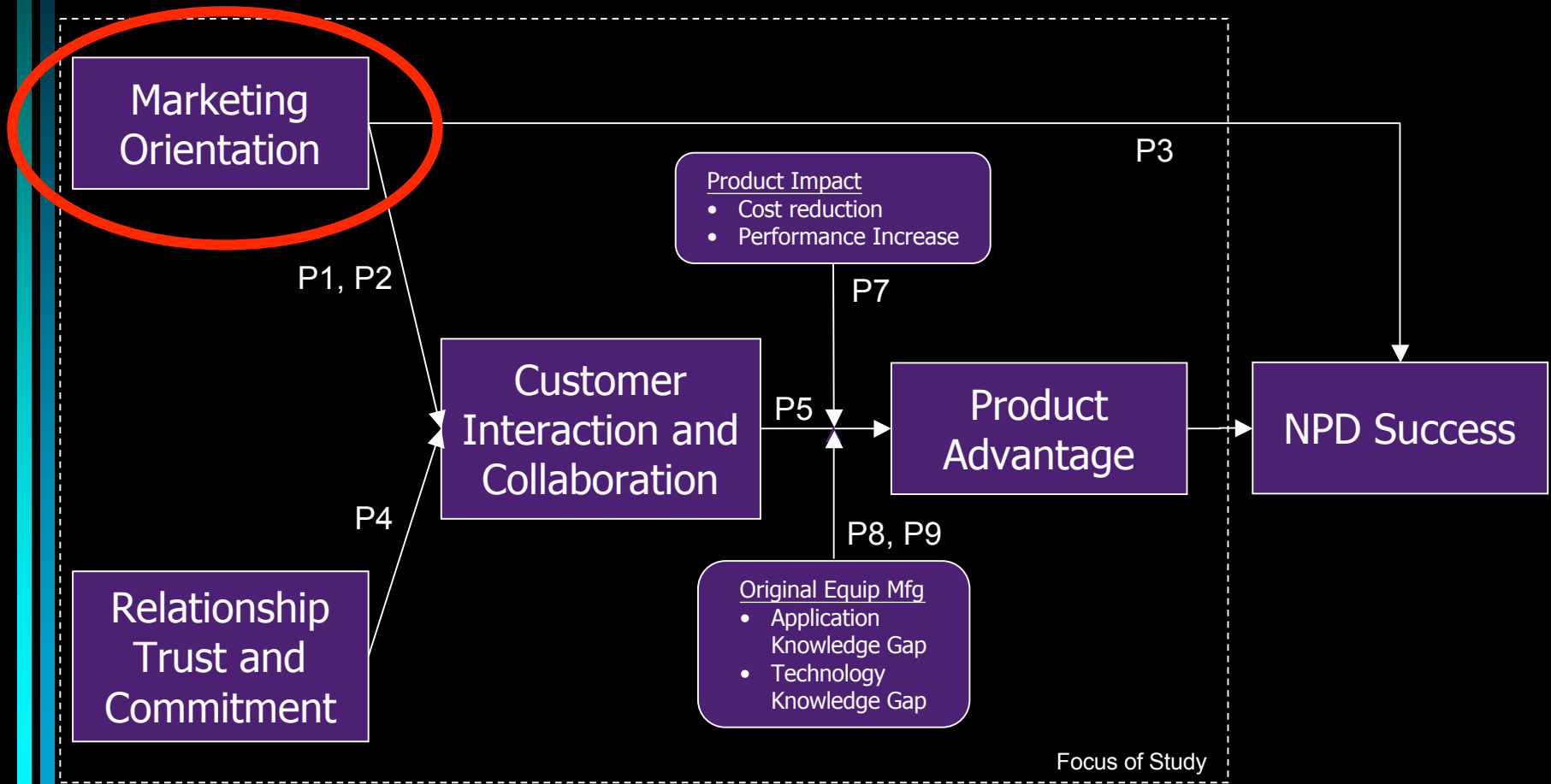
# Customer Involvement in NPD



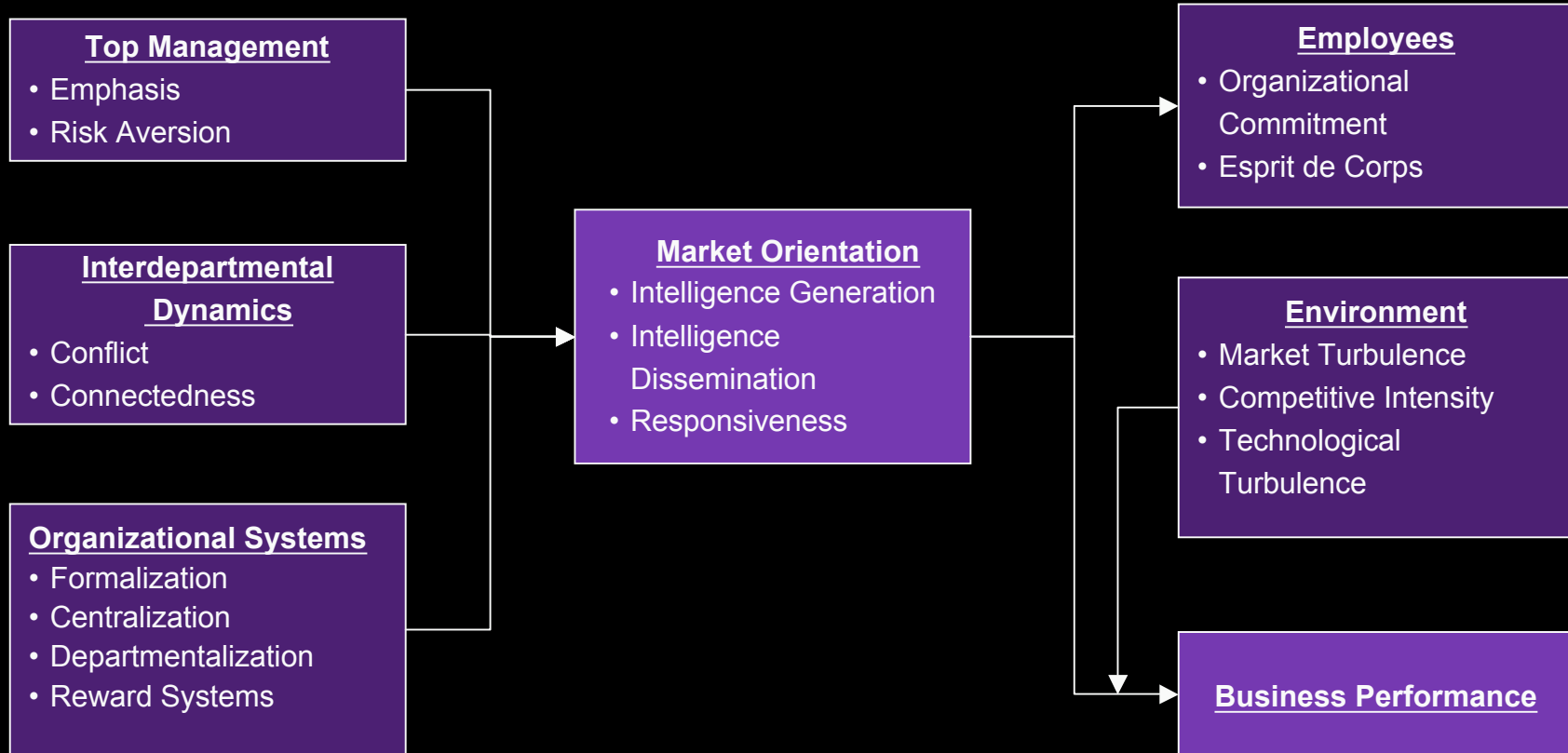
# Customer Interaction and Collaboration (CIC) in Product Development



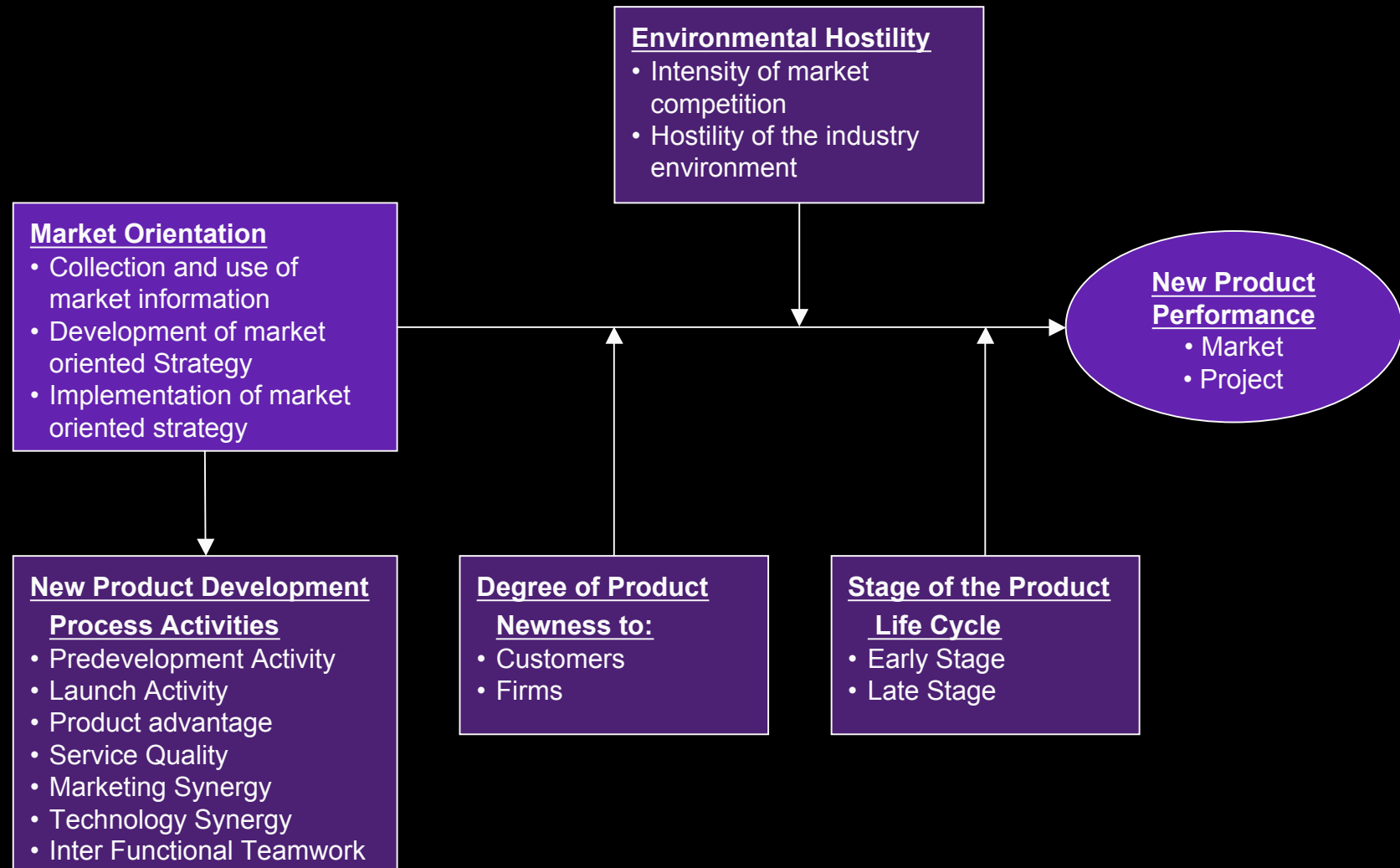
# Customer Interaction and Collaboration (CIC) in Product Development



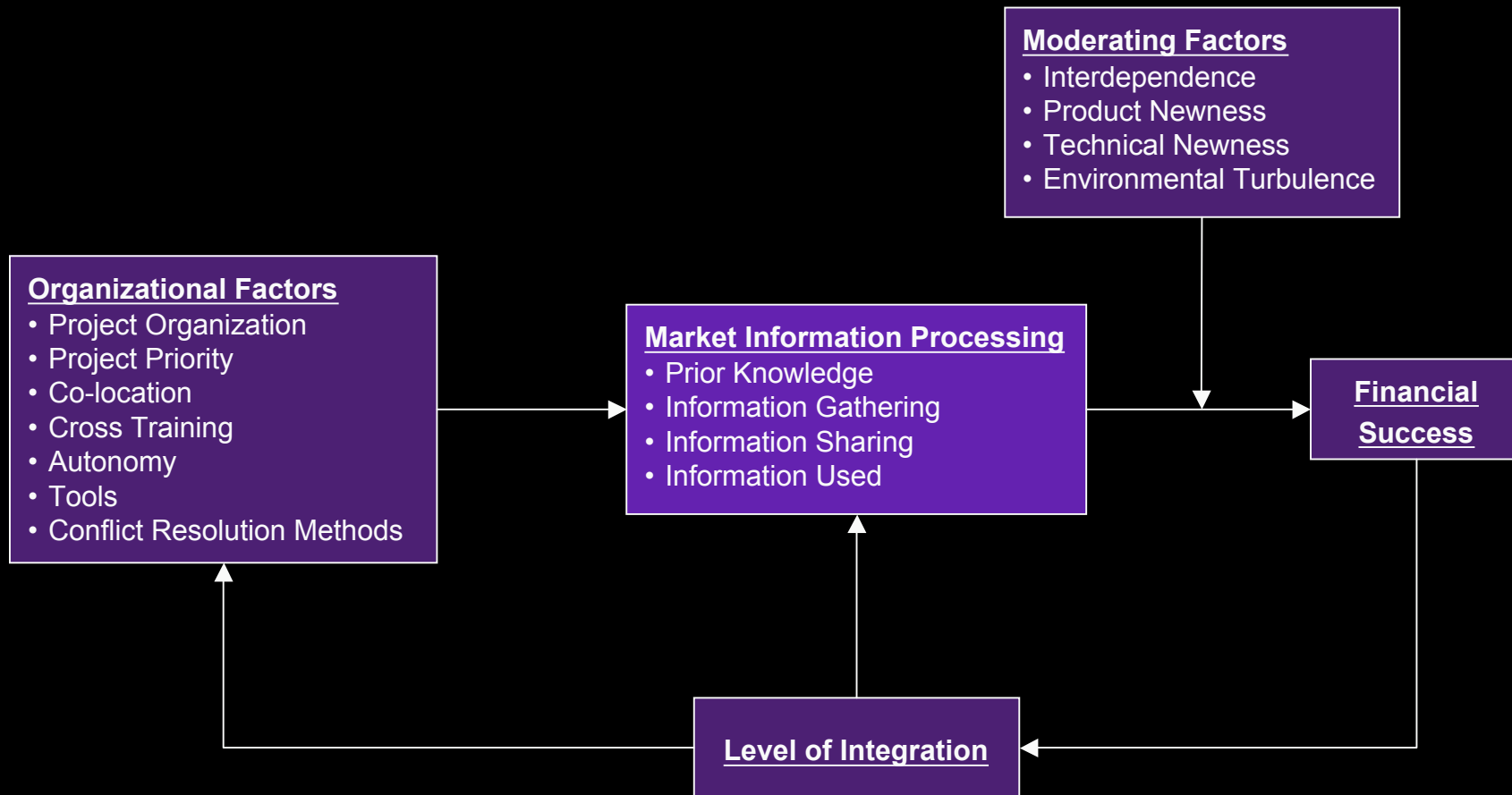
# Market Orientation



# NPD and Market Orientation



# NPD and Market Orientation



**P1: A market orientation will encourage firms to involve customers in their product development efforts.**

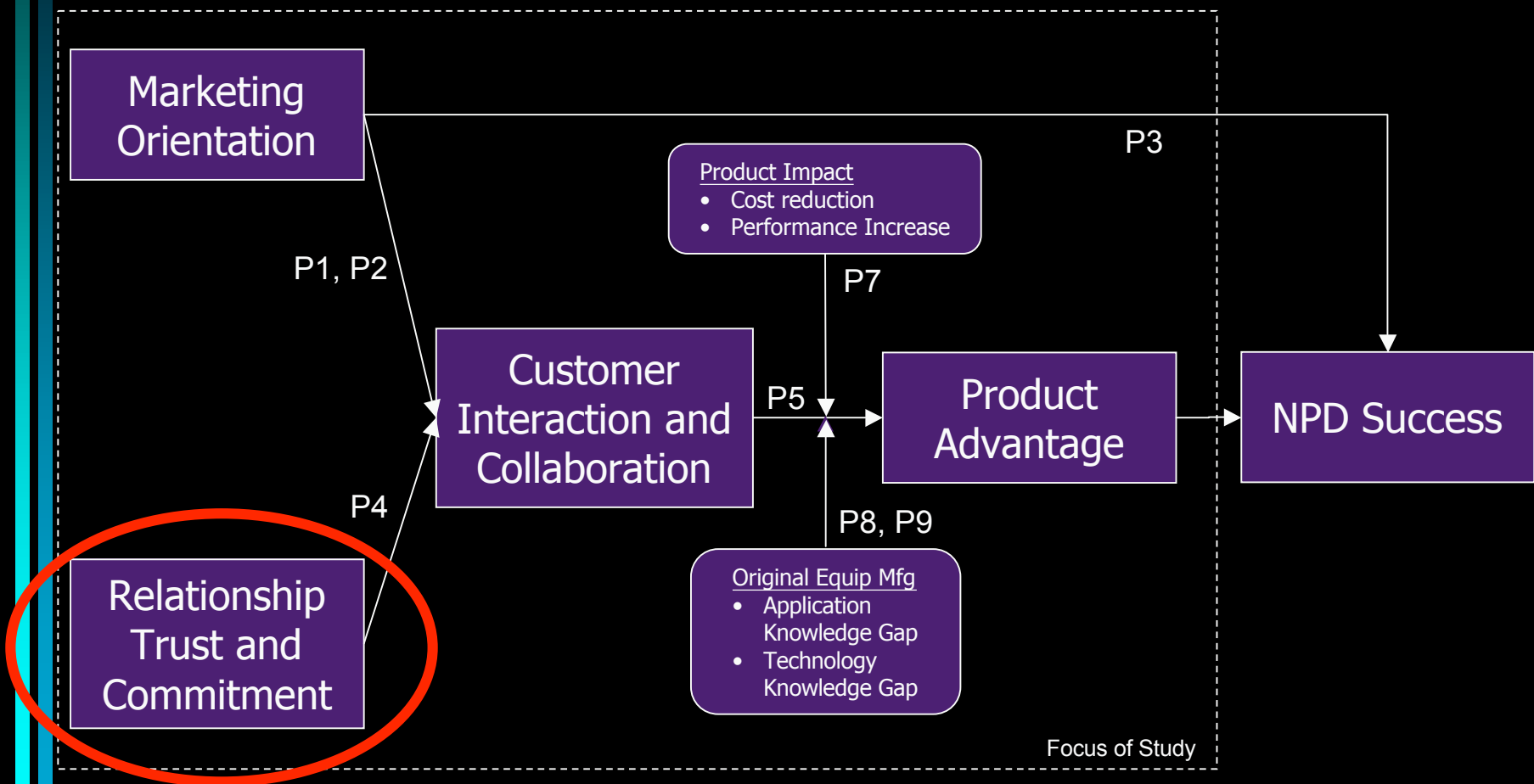
P1a: A market orientation will encourage firms to involve customers in their product development efforts, regardless of the perceived technology knowledge gap.

P1b: A market orientation will encourage firms to involve customers in their product development efforts, regardless of the perceived application knowledge gap.

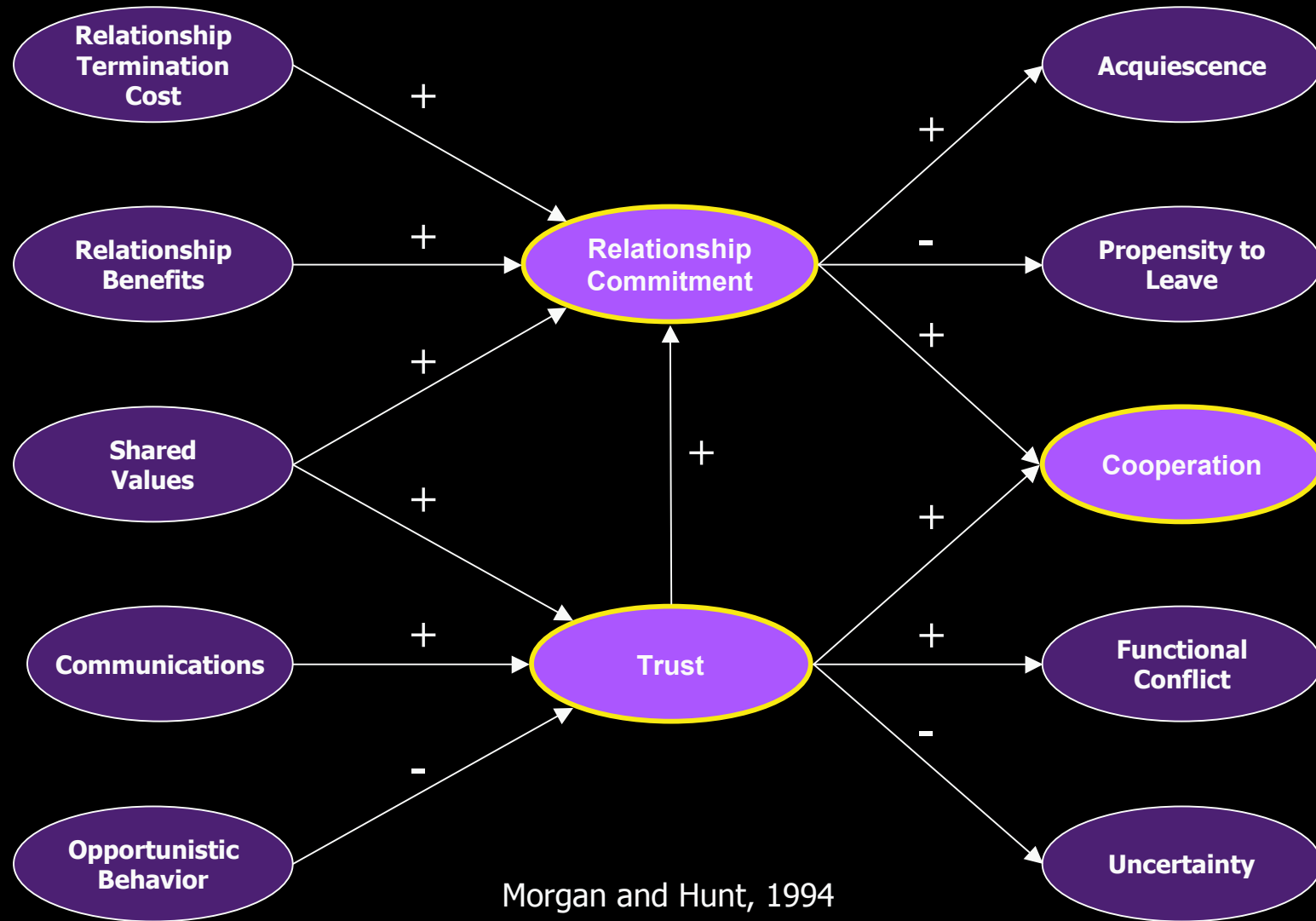
**P2:** A market orientation will encourage firms to involve customers in product development efforts at all stages of development.

**P3: A market orientation has a direct effect on the success of a firm's new products.**

# Customer Interaction and Collaboration (CIC) in Product Development



# Commitment-Trust Theory



Morgan and Hunt, 1994

## Customer Relationship and CIC

- CIC in the new product development constitutes a relationship between the manufacturer and the customer
- Lacking trust firms will not engage customers in their new product development
- Lacking commitment firms will not overcome the challenges of CIC
- Without commitment and trust cooperation is impossible

## Interview Clip - Choosing the right customer

- Someone willing to look at new technology still under development
- Someone with whom we have a strong relationship
- Someone that is forward thinking in there industry
- Someone that is more innovative than their competitors



**P4: A customer commitment enable a firm to involve customers in their product development efforts.**

P4a: Customer commitment enables coaching activities.

P4b: Customer commitment enables partnering activities.

P4c: Customer commitment enables advising activities.

P4d: Customer commitment enables reporting activities.

**P4: A customer trust enable a firm to involve customers in their product development efforts.**

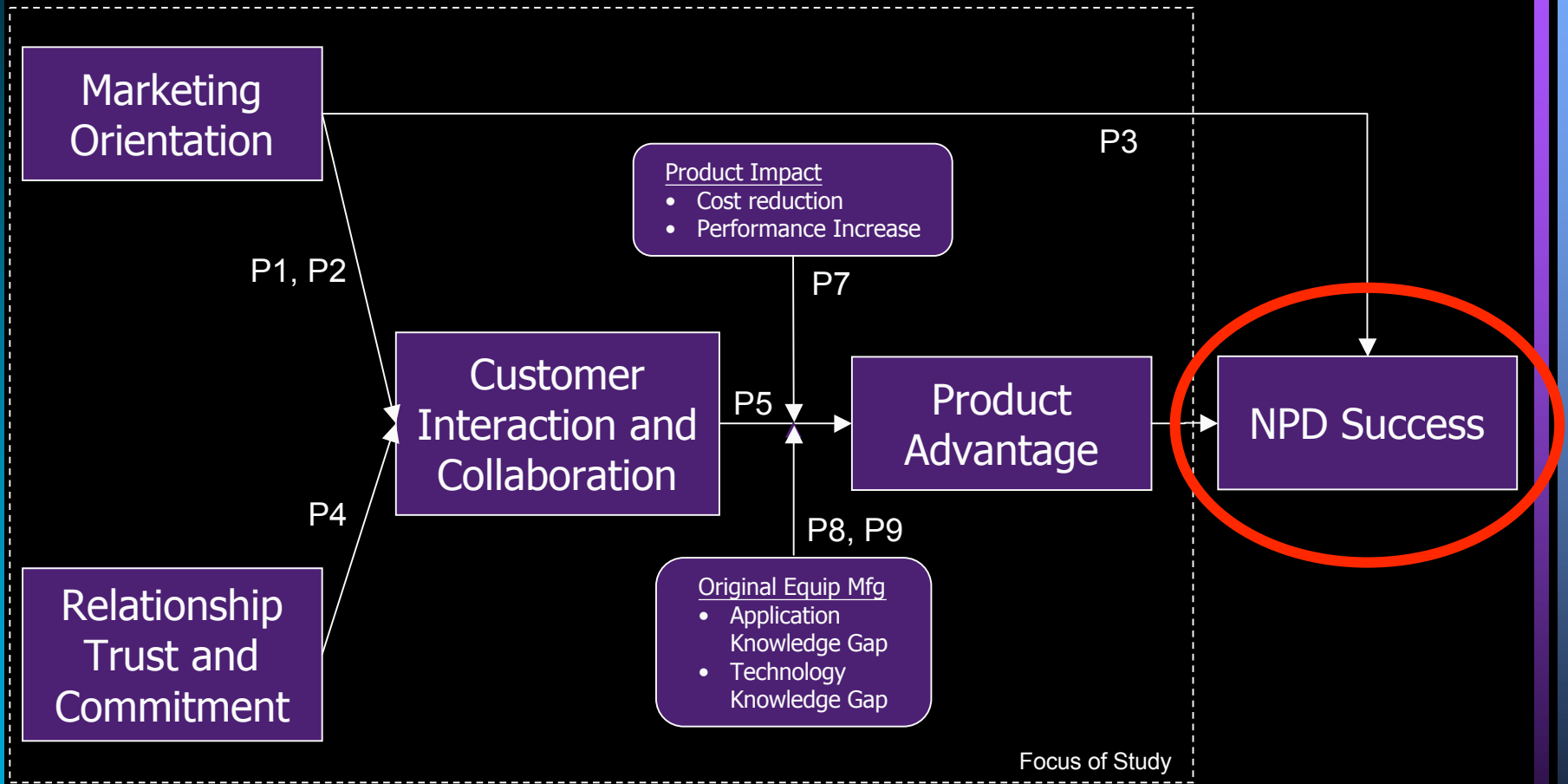
P4e: Customer trust enables coaching activities.

P4f: Customer trust enables partnering activities.

P4g: Customer trust enables advising activities.

P4h: Customer trust enables reporting activities.

# Customer Interaction and Collaboration (CIC) in Product Development



# New Product Development Success

- Prior to 1993 there were 61 research studies and 77 articles published on the subject of success and failure (*Griffin & Page 1996*)
- One of six critical success factors in a NPD is the inclusion of the voice of the customer *throughout* development (*Cooper, 1998*)
- Nearly every study of success indicates that understanding customer needs and wants is at the heart of successful NPD

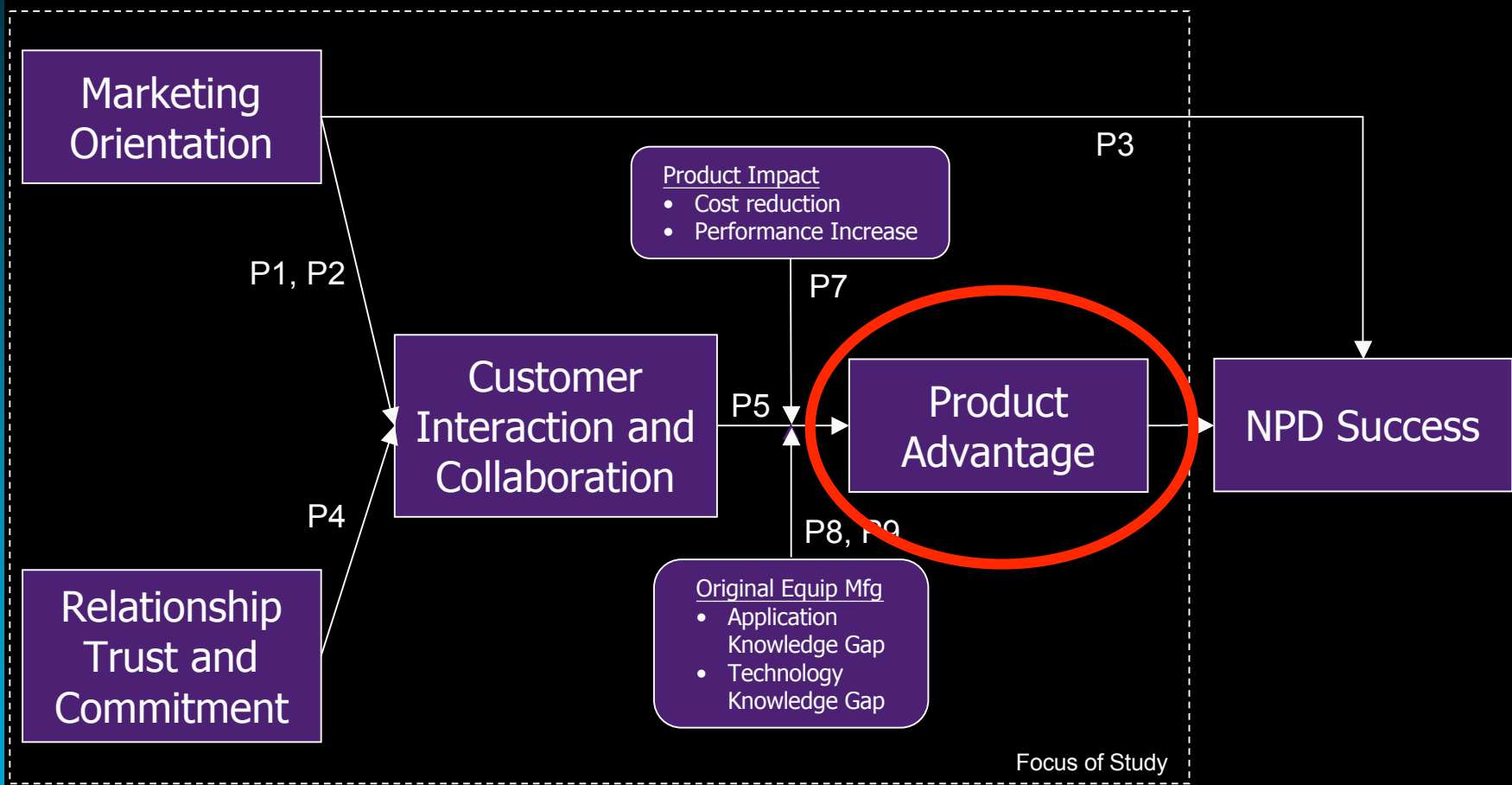
# New Product Development Success

- “Success is not just elusive; it is also multifaceted and difficult to measure” (Griffin and Page, 1996)
- Success has been measured along three dimensions (Griffin and Page, 1996)
  - Customer-based success
  - Financial-based success
  - Technical-based success
- Performance measured along the three dimensions shifts with time (Hultink, 1995)
  - Short-term focus is often on technical performance
  - Long-term focus shifts toward customer and financial

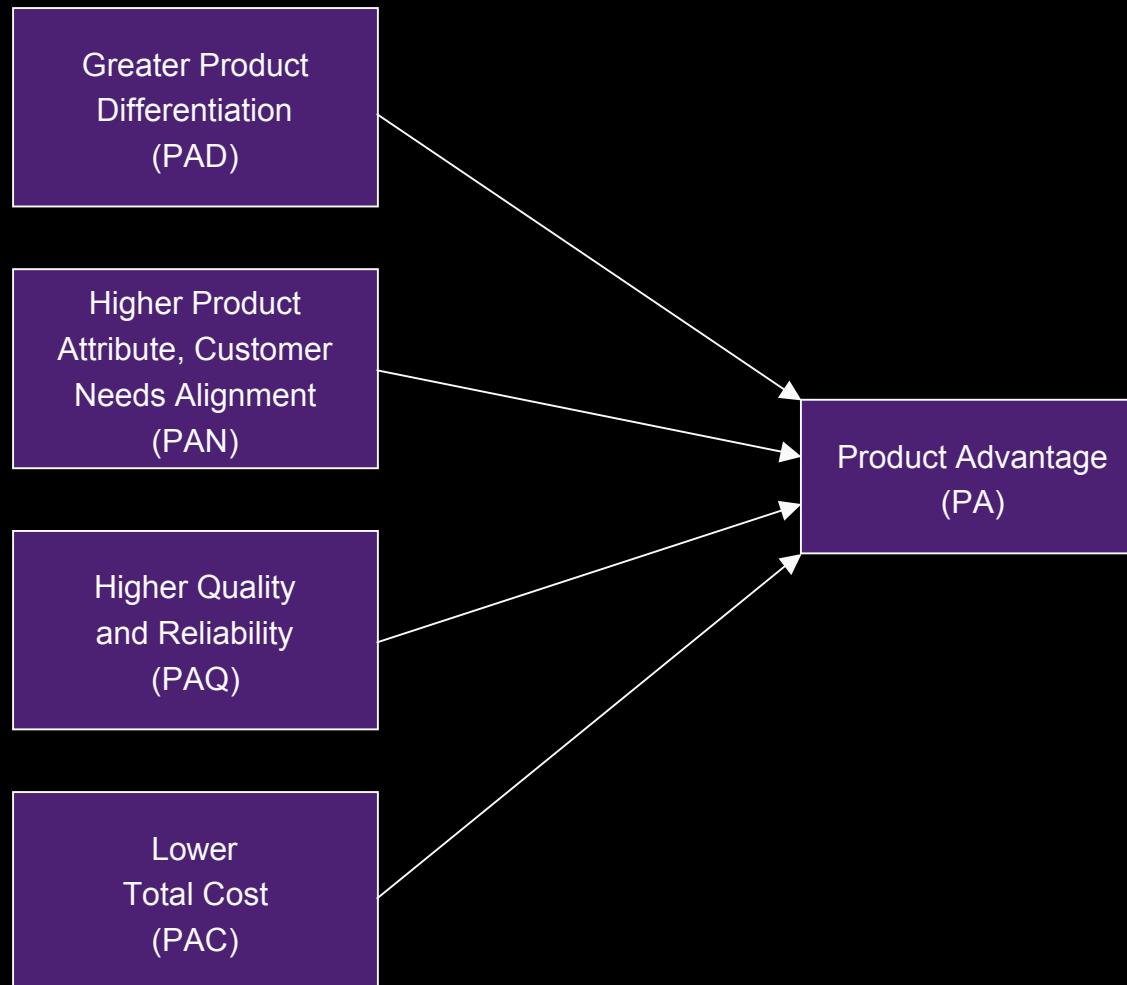
# NPD Success Measures

	Customer-Based	Financial	Technical Or Process-Based
Short-Term	<ul style="list-style-type: none"> <li>• Customer Satisfaction</li> <li>• Customer Acceptance</li> </ul>	<ul style="list-style-type: none"> <li>• Development Cost</li> </ul>	<ul style="list-style-type: none"> <li>• Performance to Spec.</li> <li>• Time to Market</li> <li>• Quality</li> <li>• Performance To Schedule</li> <li>• Innovativeness</li> <li>• Competitive Advantage</li> </ul>
Long-Term	<ul style="list-style-type: none"> <li>• Number Of Customers</li> <li>• Unit Volume</li> <li>• Number Of Percent Repeat Customers</li> </ul>	<ul style="list-style-type: none"> <li>• Revenue</li> <li>• Profit</li> <li>• Rate Of Return</li> <li>• Payback Period</li> <li>• Market Share</li> </ul>	<ul style="list-style-type: none"> <li>• Time To Volume</li> </ul>

# Customer Interaction and Collaboration (CIC) in Product Development



# Product Advantage



## *Product Differentiation (PAD)*

- How new and unique is your product?
- Did it use new technology or old technology in a new way?
- What was its effect on the market?

## *Product Differentiation (PAD)*

<b>Measures</b>	<b>Author(s)</b>
This product relied on technology never used in the industry before.	(Song and Parry 1997a; Song and Parry 1997b)
This product caused significant changes in the whole industry.	(Song and Parry 1997a; Song and Parry 1997b)
The product was on of the first of its kind introduced into the market.	(Song and Parry 1997a; Song and Parry 1997b)
This product was highly innovative – totally new to the market.	(Song and Parry 1997a; Song and Parry 1997b)
We were the first into the market with this type of product.	(Song and Parry 1997a; Song and Parry 1997b)

## *Product Attribute, Customer Needs Alignment (PAN)*

- How well does your product meet customer needs versus your competitors?
- Does it allow customers to perform a new job or task?
- Does it allow customers to do an old job or task better?

## *Product Attribute, Customer Needs Alignment (PAN)*

<b>Measures</b>	<b>Author(s)</b>
This product was clearly superior to competing product in meeting customers' needs.	(Song and Parry 1997a; Song and Parry 1997b)
This product has superior technical performance relative to competing products.	(Song and Parry 1997a; Song and Parry 1997b)
This product permitted the customer to do a job or something they could not presently do with what was available.	(Song and Parry 1997a; Song and Parry 1997b)
Compared to competitive products, this product offered some unique features or attributes to this customer.	(Song and Parry 1997a; Song and Parry 1997b)

## *Product Quality/Reliability (PAQ)*

- How durable, reliable, stronger, etc. is your product against competing product?
- Can your customers visualize this?

## *Product Quality/Reliability (PAQ)*

<b>Measures</b>	<b>Author(s)</b>
Our customers often praise our product quality.	(Menon et al. 1997)
This product was higher quality than competing products – tighter specifications, stronger, lasted longer, or more reliable.	(Song and Parry 1997a; Song and Parry 1997b)
Our customers are firmly convinced that we offer very good quality products.	(Menon et al. 1997)
This product has high reliability meaning, the extent to which the product is free from errors.	(Li and Calantone 1998)

## *Reducing Customer Costs (PAC)*

- Can your product increase a customer's productivity?
- Will it lower their costs in other ways?
- How does it compete by price?

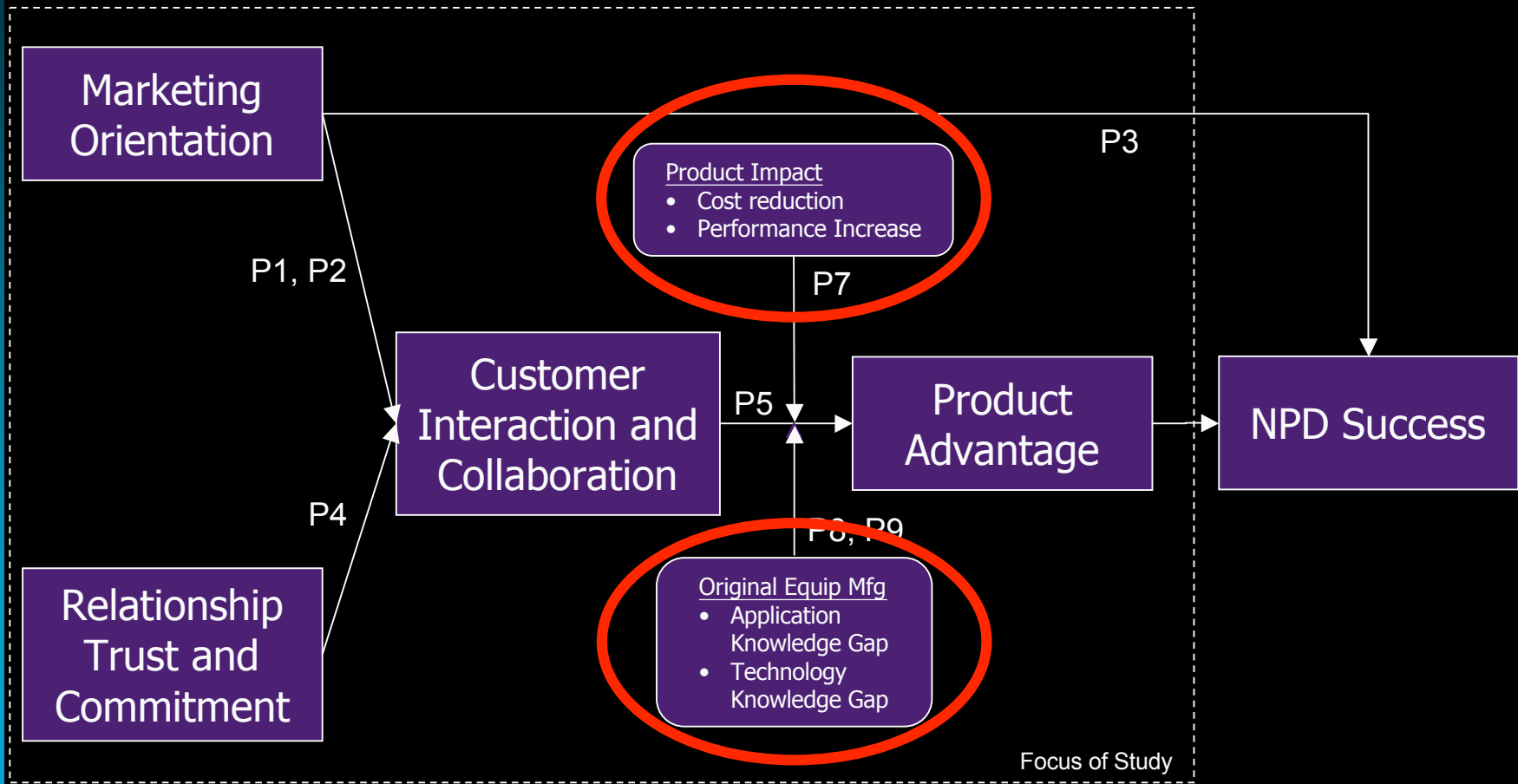
## *Reducing Customer Costs (PAC)*

Measures	Author(s)
Product is superior in terms of productivity, meaning, extent to which the product increases customers' efficiency.	(Li and Calantone 1998)
Product is superior to competing products in terms of lowering customer costs.	(Cooper 1990)
Product had a lower price versus competitive products.	(Cooper 1990)

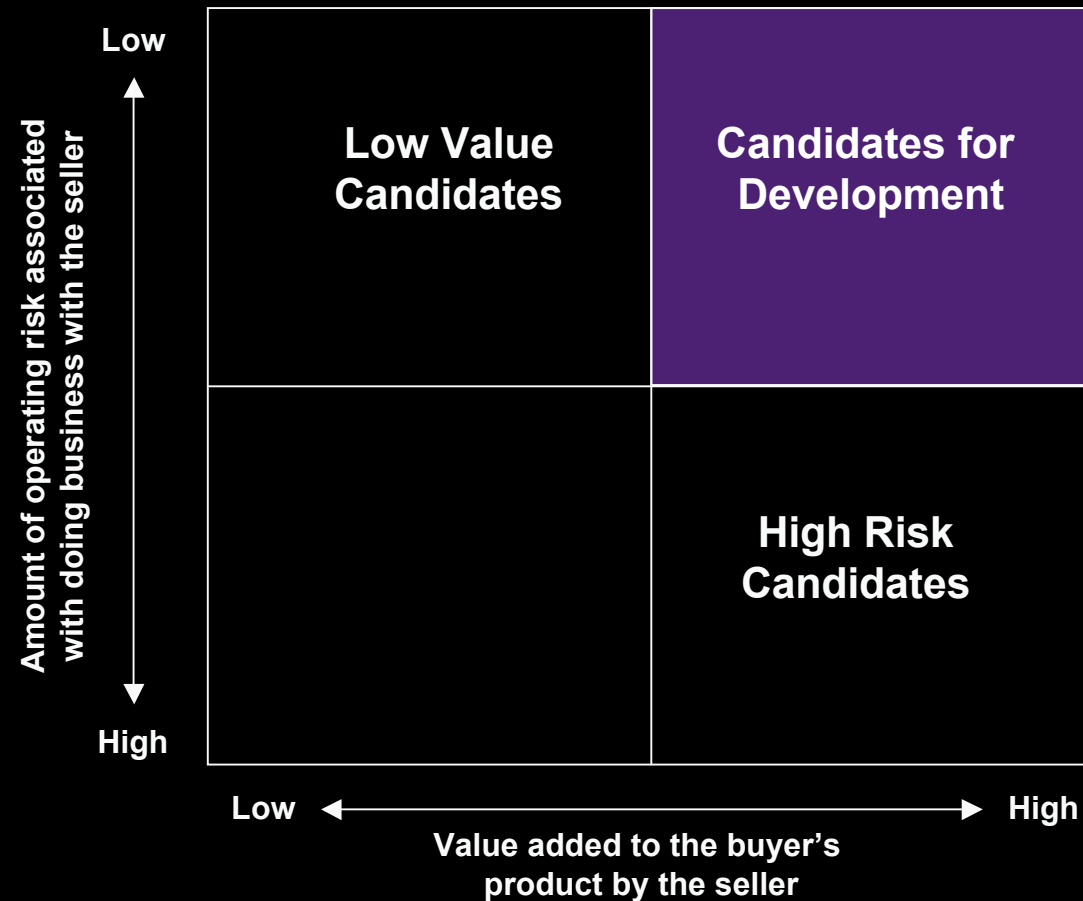
## P5: CIC in product development will improve product advantage.

- P5a: CIC in product development will lead to the development of products with greater differentiation than competitive products.
- P5b: CIC in product development will lead to the development of products with greater alignment between product attributes and customer needs than competitive products.
- P5c: CIC in product development will lead to the development of higher quality products than competitive products.
- P5d: CIC in product development will lead to the development of products which lower customer cost relative to competitive products.

# Customer Interaction and Collaboration (CIC) in Product Development



# Product Impact on the Customer



Source: An integrated model of buyer-seller relationships – David T. Wilson, 1995

**P6: CIC in product development will generally occur in areas of high-impact.**

P6a: CIC in product development will generally occur in areas where the value added to the buyer's product by the seller is high.


P6b: CIC in product development will generally occur in areas where the amount of operating risk associated with doing business with the seller is low.

**P7: Perceived product impact on the customer will moderate the relationship between CIC and product advantage, with CIC being more important at higher levels of perceived product impact.**

**P8:** An OEM's perceived application knowledge gap will moderate the relationship between CIC and product advantage, with CIC being more important when larger perceived application knowledge gap exists.

**P9:** An OEM's perceived technology knowledge gap will moderate the relationship between CIC and product advantage, with CIC being more important when larger perceived technology knowledge gap exists.

# Agenda

- Scope, Motivation and Research Questions
- Research Design and Methodology
- Customer Interaction and Collaboration (CIC)
- CIC Framework
  - CIC
  - Market Orientation
  - Relationship Commitment and Trust
  - NPD Success & Product Advantage
  - Product Impact on the Customer (Customer Relevance)
  - OEM Knowledge Gap
-  Future Research

## Potential Managerial Implications

- The role of customer is not constant.
- Different customer roles present varying degrees of relationship complexity.
- The level of CIC is not a constant

## CIC Impediments

- Over customization of products
- Confidentiality
- Identification of customers
- Lack of customer cooperation

# Future Research

- Empirical Test of Framework

# Customer Interaction and Collaboration (CIC) in Product Development

