How Lean Product Development Came Back to Japan

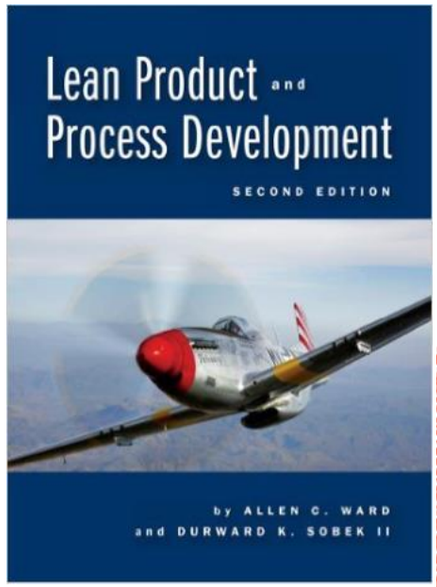
精益产品开发在日本的实践

Kimio Inagaki
稲垣公夫

Globaling Inc

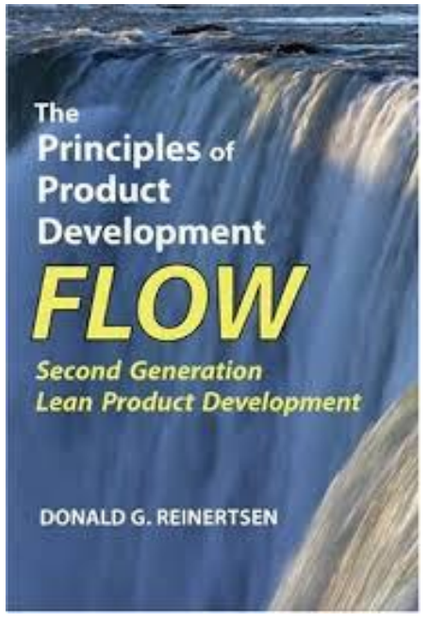
What is Lean Product Development?
何为精益产品开发？

Toyota Product Development System
丰田产品开发系统



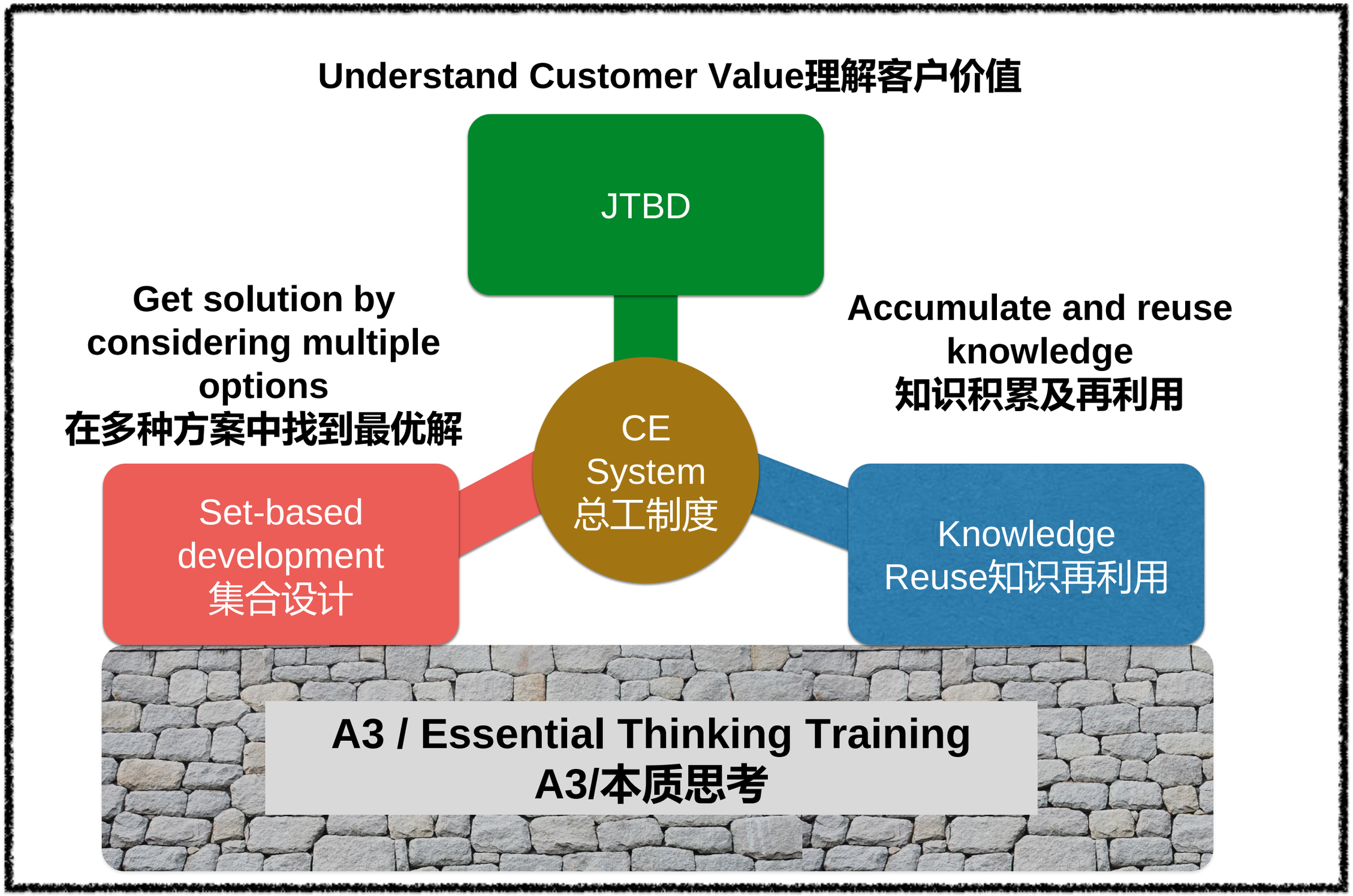
- **Understanding customer value 理解客户价值**
- **Front loading 开发前置**
- **Rapid learning cycle 快速学习闭环**
- **Knowledge creation and re-use知识创造及再利用**
- **Problem Solving A3 问题解决A3**

Toyota Production System
丰田生产体系



- **Product development flow 产品开发流**
- **VSM 价值流图**
- **Visual planning 目视化的规划**

Major Components of LPD
精益产品开发（LPD）的整体框架



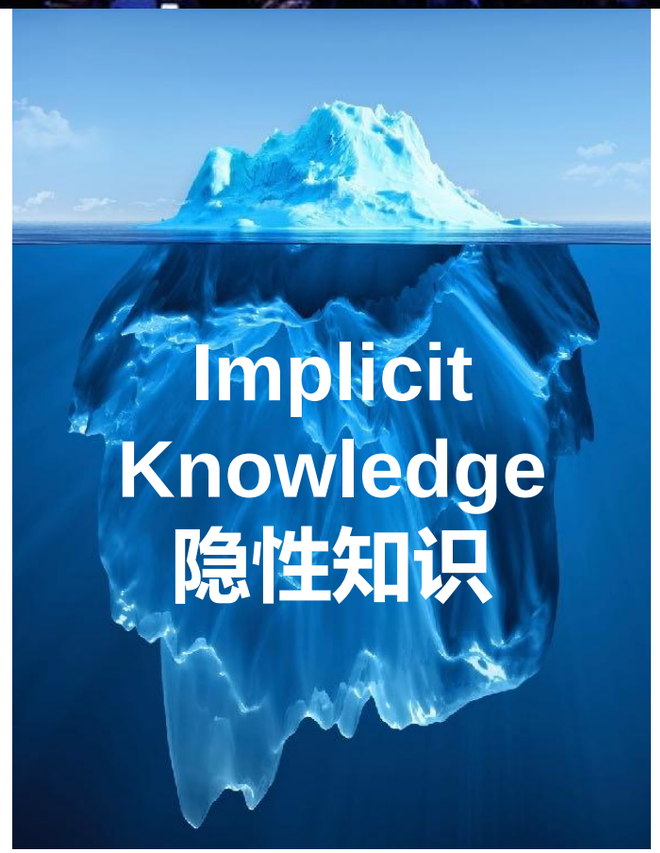
Lean Journeys of Japanese Companies
日本企业的精益产品开发实践

LPD Objectives in Japan
在日本推行精益产品开发（LPD）的目的

- Improve ability to create compelling product concepts 增强 “爆款” 产品的开发能力

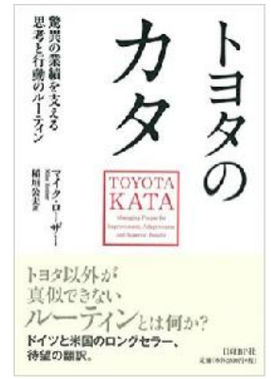
- Integrate product planning and conceptual design seamlessly 无缝连接产品规划和概念设计

- Systemize development method of super engineers being lost, to make it repeatable, transferrable 将 “卓越工程师” 的经验套路系统加以总结，使其可以重复利用并有效传承。



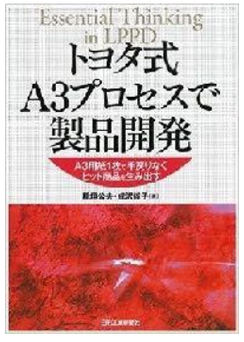
How LPD Came Back To Japan
精益产品开发是如何回到日本的？

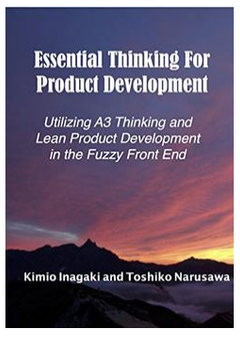
Lean Production
精益生产



1997 2004 2007 2012 2014 2015 2016 2017

Lean Product Development
精益产品开发





Traditional Chinese
繁体中文版

Simplified Chinese
简体中文版

Key Elements of LPD
精益产品开发的关键要素

- **JTBD** - Understand customer value
  JTBD（Jobs to be Done）- 理解客户价值

- **Set based development** - Connect customer value knowledge to design decisions
  集合设计 – 将客户价值转化成设计决策

- **Analogy thinking** - Get breakthrough ideas by borrowing from afar
  类比思维 – 跨界汲取好的经验，突破创新

- **Fast and cheap experiment** - Learn quickly
  快速和低成本的试验 – 快速学习

- **Knowledge re-use** - Don’t reinvent the wheel
  知识再利用 – 避免开发过程中一次次的重蹈覆辙

Product development team must understand customer value
产品开发团队必须深刻理解客户价值

JTBD (Jobs To Be Done)
JTBD方法

- **Customers hire products and services to get Jobs done**

  客户是通过“雇佣”产品服务完成要解决的“任务”；

- **Customers pay money for Outcome Expectation which shows how well the job has been done**

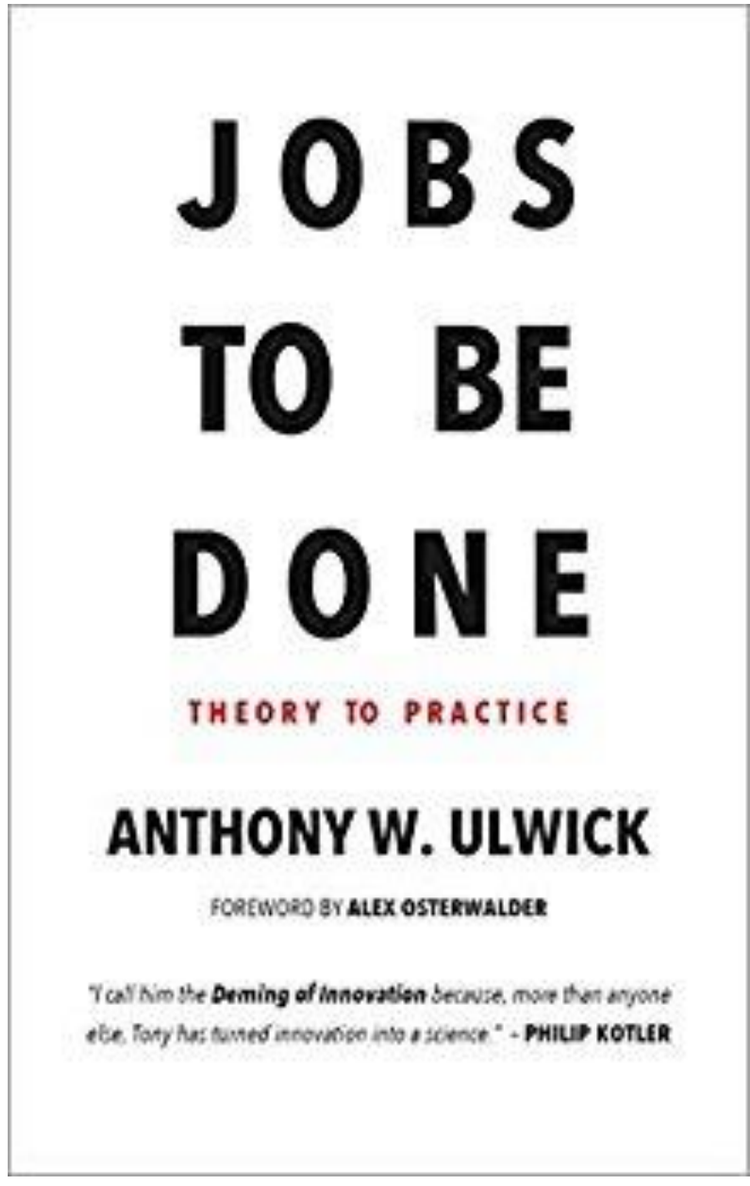
  客户为“产出”付费，体现了“任务”完成的好坏；

- **Solutions change but jobs remain stable over time**

  解决方案一直会变，但“任务”一直很稳定；

- **VoC focuses on ‘what, JTBD on ‘why’ or ‘motivation’**

  VOC强调“是什么”，而JTBD强调“为什么”或者“动机”。



Solutions May Change Over Time but Jobs Remain Stable
解决方案一直会变，但“任务”一直很稳定

Job 任务	Old Solution 老的解决方案	New solution 新的解决方案
Get medicine into body人体医学治疗	Pills/ injection药片/ 注射	Skin patch皮肤贴布
Get meteorological info获得气象信息	Thermometer, barometer 温度计、气压计	Weather satellite 气象卫星
Listen to music while outside户外听音乐	Radio，Walkman收音机、单放机	iPod
Keep windows clean保持玻璃窗干净	window cleaning squeeze 擦洗玻璃窗	Self-cleaning glass 自洁式的玻璃

1955

1979

2001

Where is the Market Under-served?
哪里是市场还未得到满足的空白地带？

Satisfaction市场满足度

10
9
8
7
6
5
4
3
2
1

Over Served 过度满足
Not important but well satisfied
重要性不高但市场满足度很高

Maximize air suction volume
吸气量的最大化

Minimize dust in exhaust air
排气中的灰尘最小化

Appropriately Served 适当满足

Under served 尚未满足
Important and not satisfied
重要但市场还未得到有效满足

1 2 3 4 5 6 7 8 9

Importance重要度

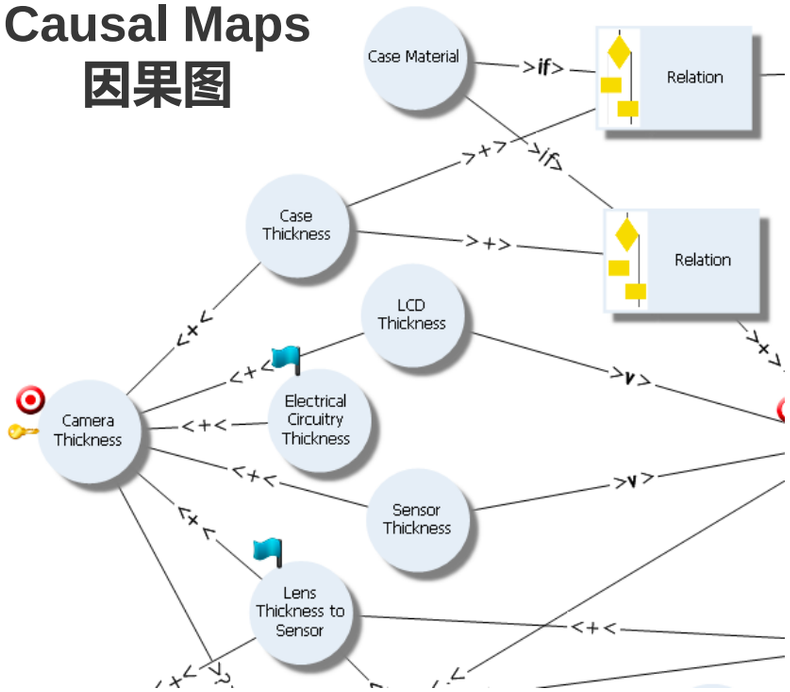
Connecting Customer Value to Design Decisions using Set Based Development

通过集合设计将客户价值转化成设计决策

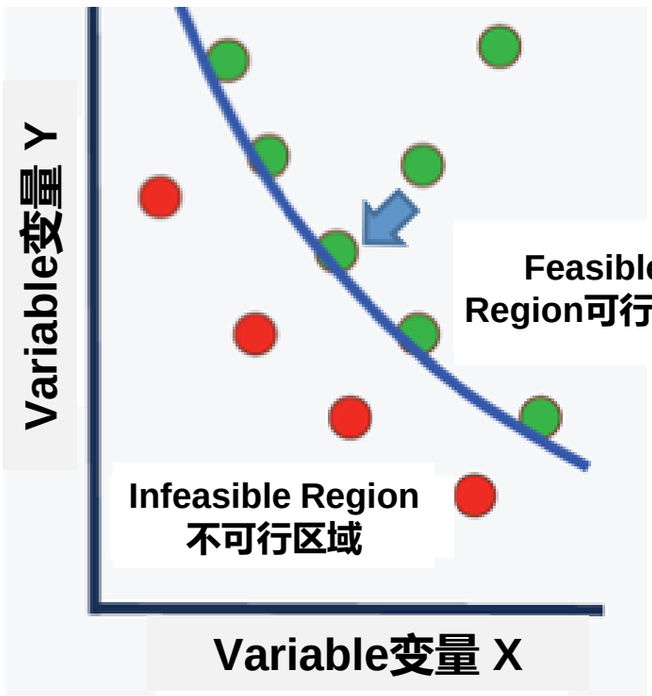
Information used for connecting to design decisions
连接设计决策时所需的信息

- What is the design variable which influences customer value? 什么是影响客户价值的设计变量？

Causal Maps
因果图

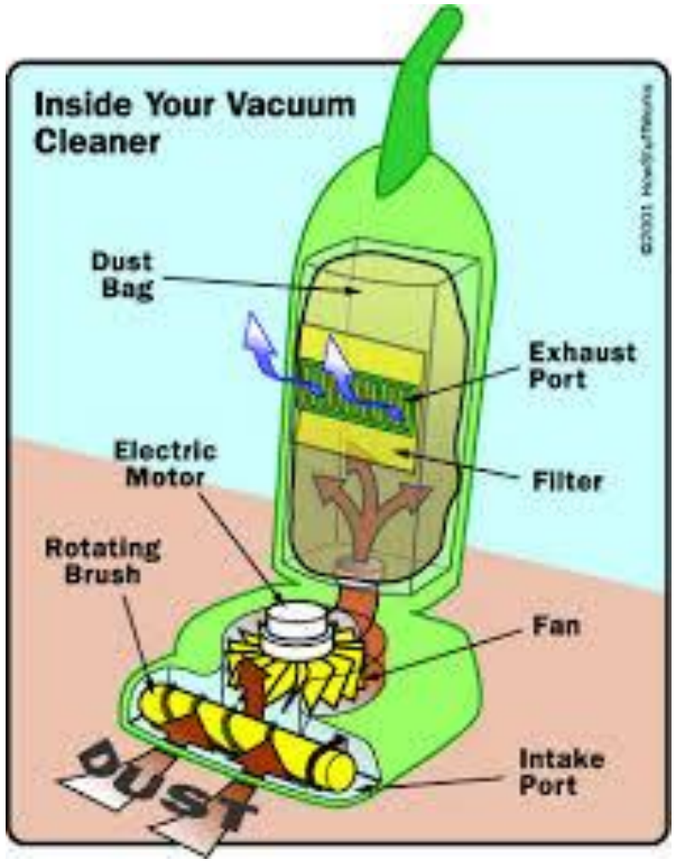


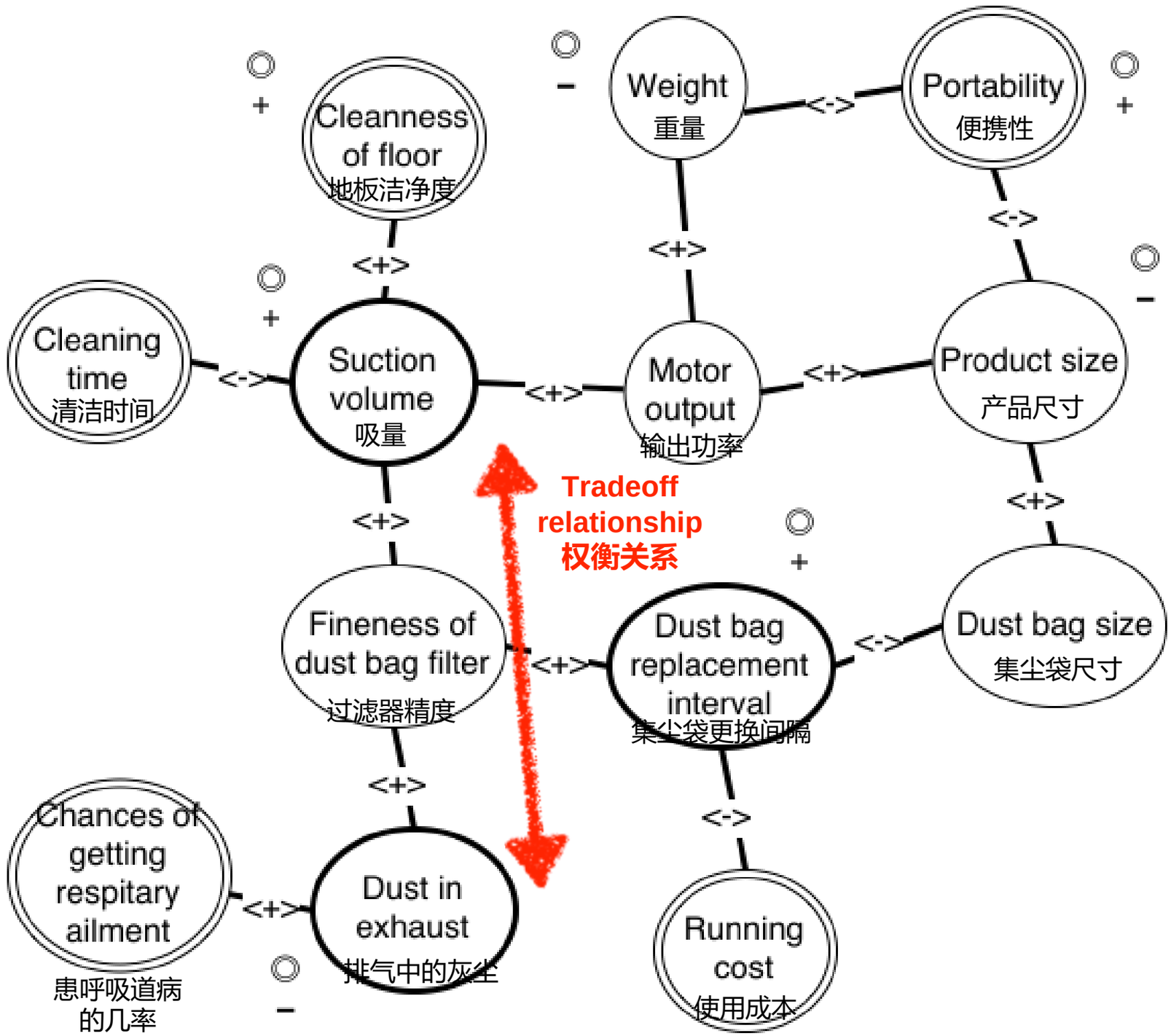
- What values should design variables take to achieve product concept? 为了能够实现产品的设计概念，应该取怎样的设计变量？



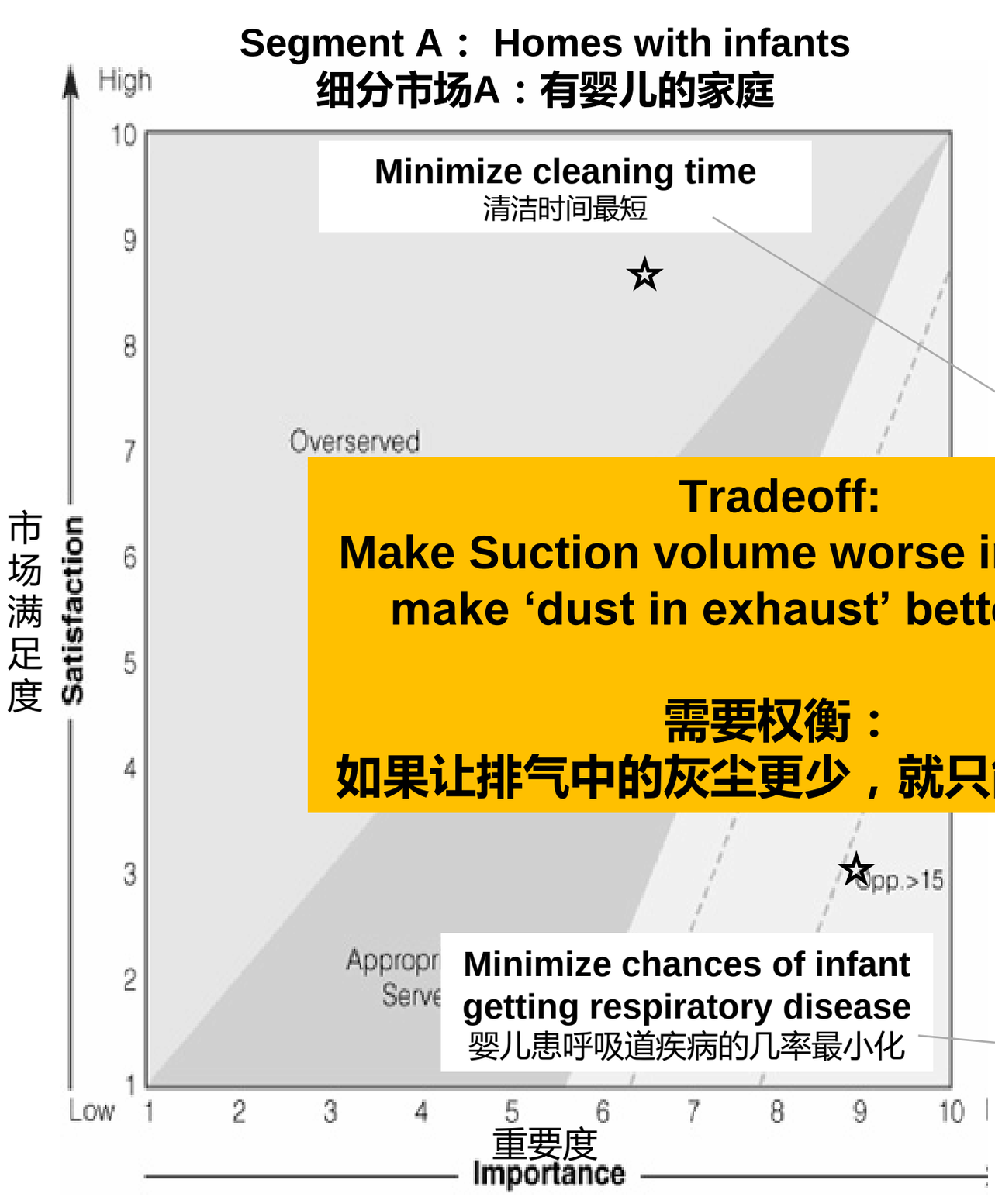
Tradeoff Curves
权衡曲线

Vacuum Cleaner Causal Map / Tradeoff curve
吸尘器的因果图和权衡曲线



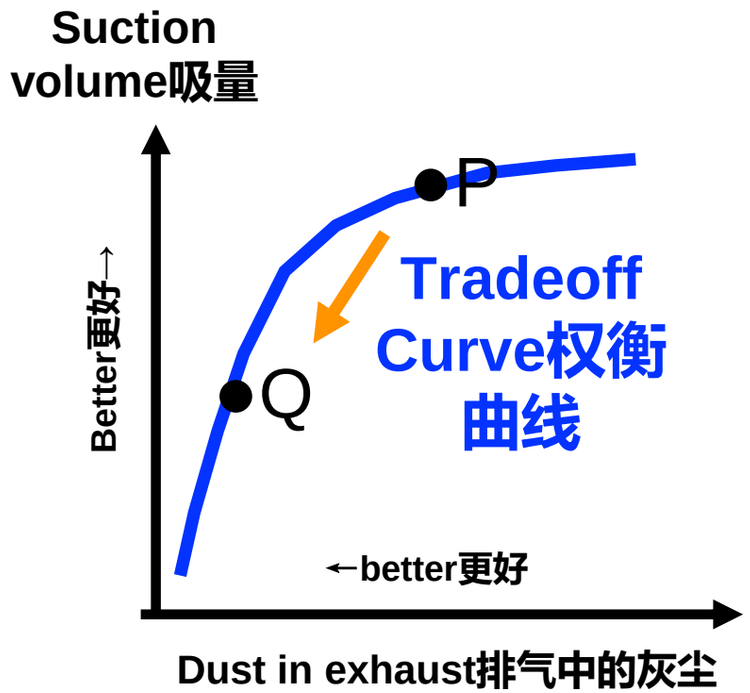


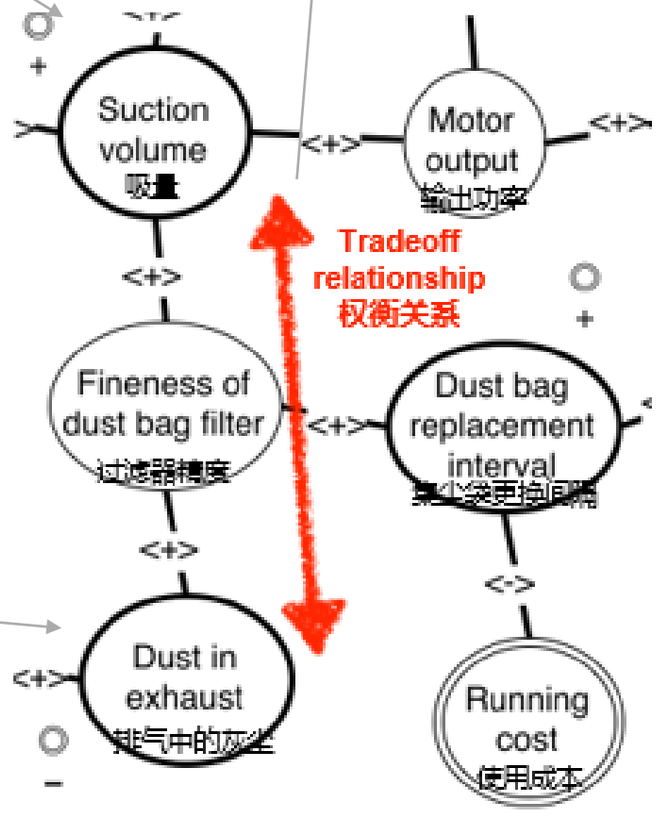
Tradeoff between Over-served and Under-served Outcomes
“过度满足”和“尚未满足”选项之间的权衡关系



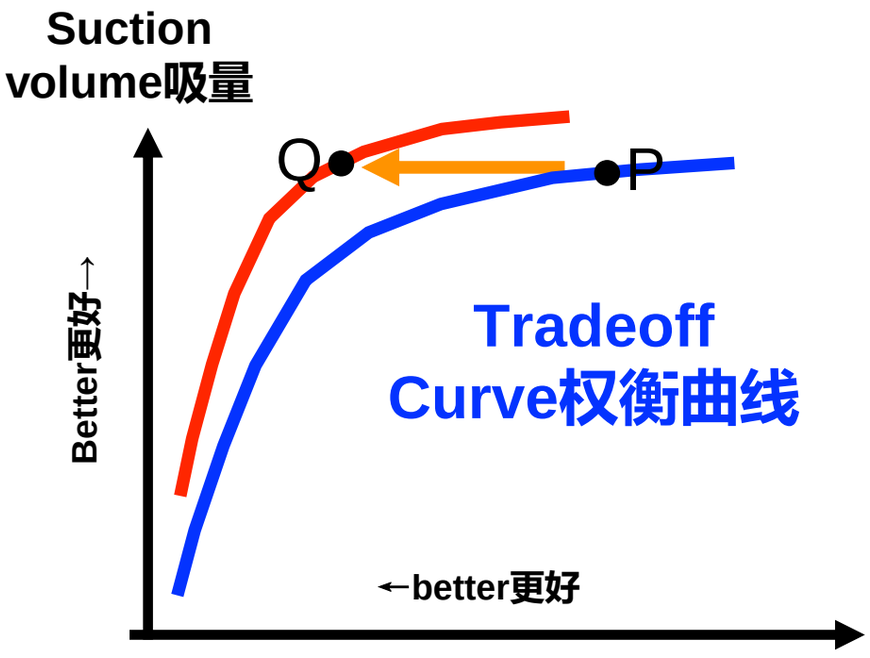
Tradeoff:
Make Suction volume worse in order to make ‘dust in exhaust’ better (less)

需要权衡：
如果让排气中的灰尘更少，就只能减弱吸量

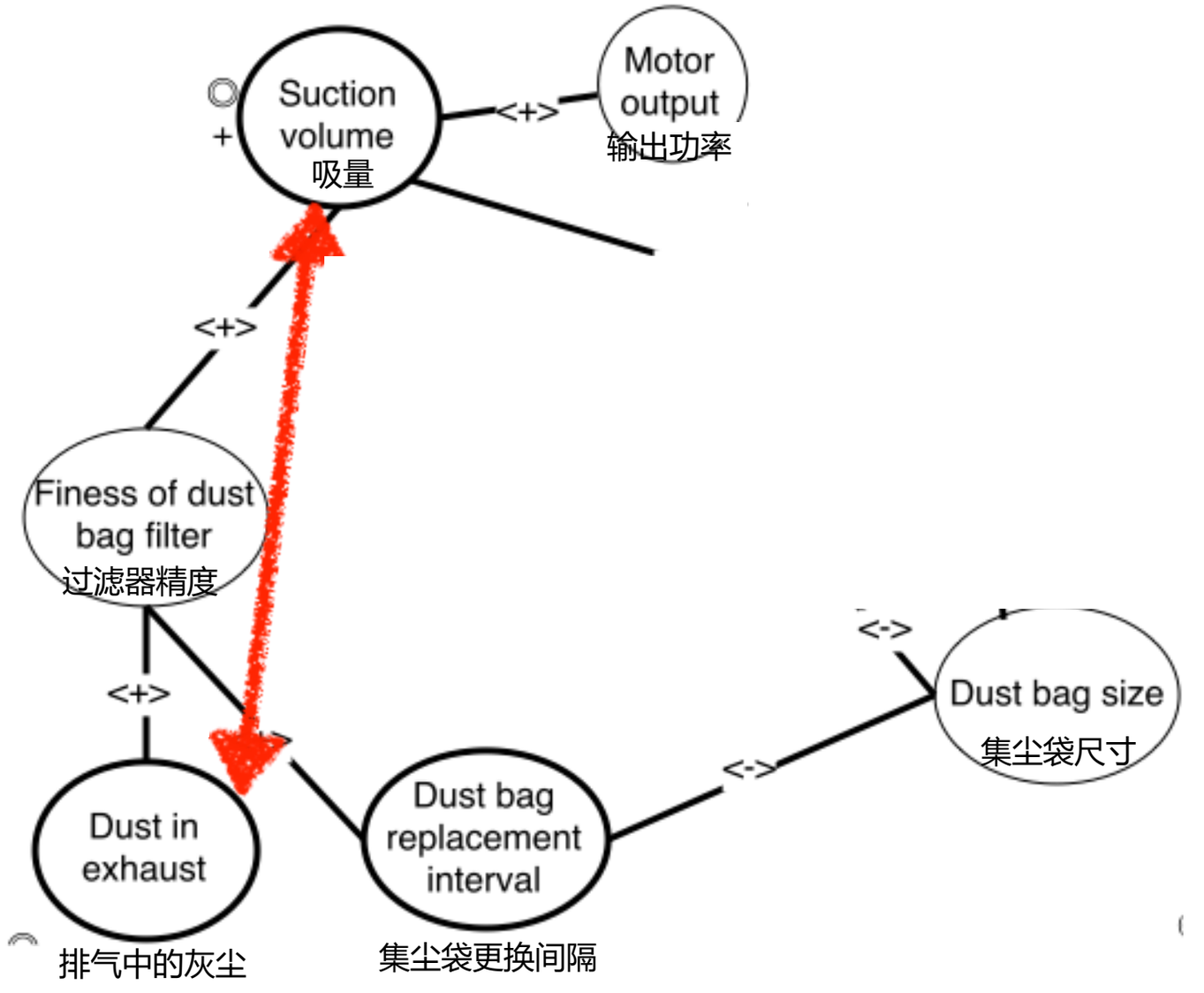




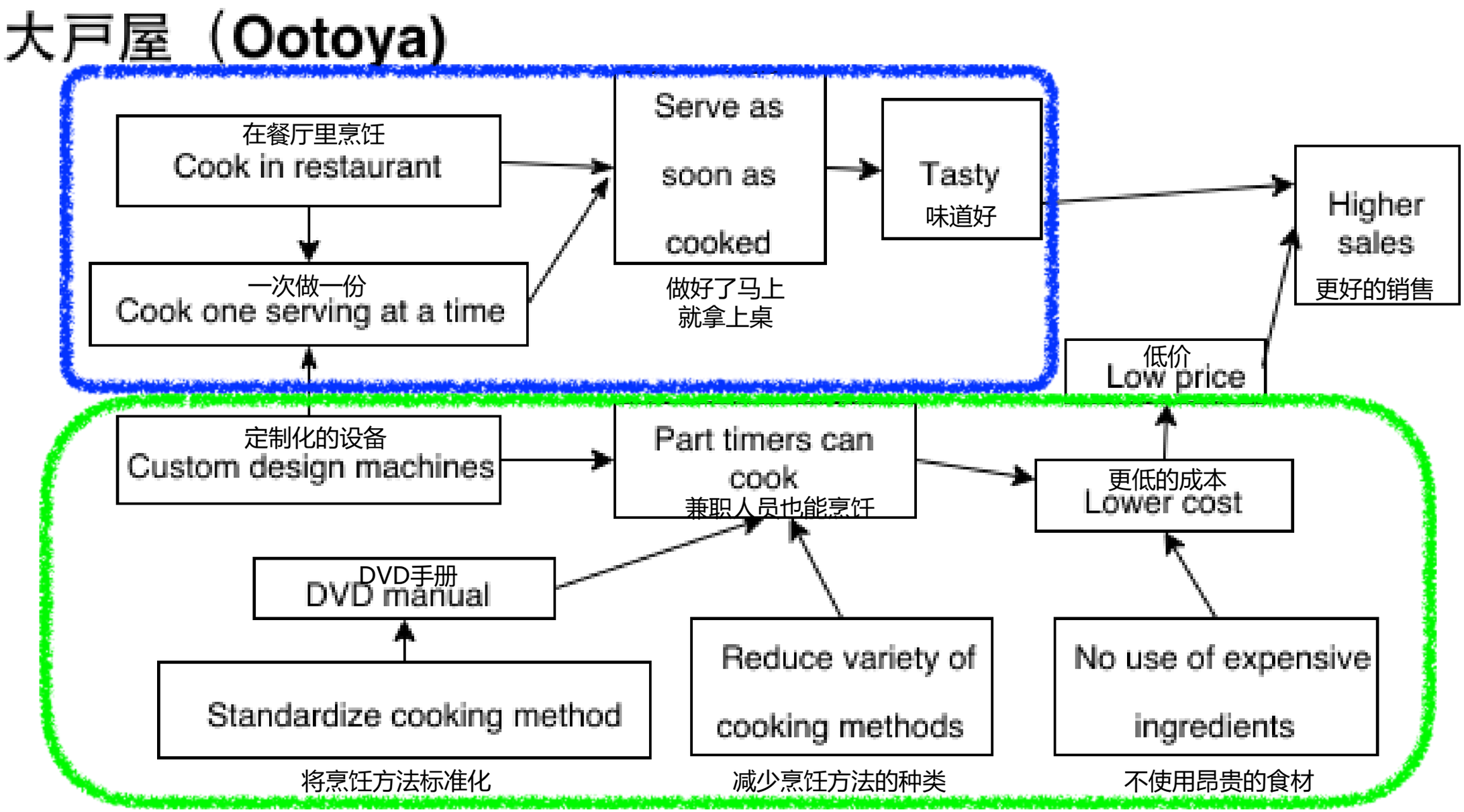
Using Analogy Thinking to get Breakthrough Ideas
运用类比思维，获得突破创新



borrow solutions from different products
从别的产品解决方案中获得启发

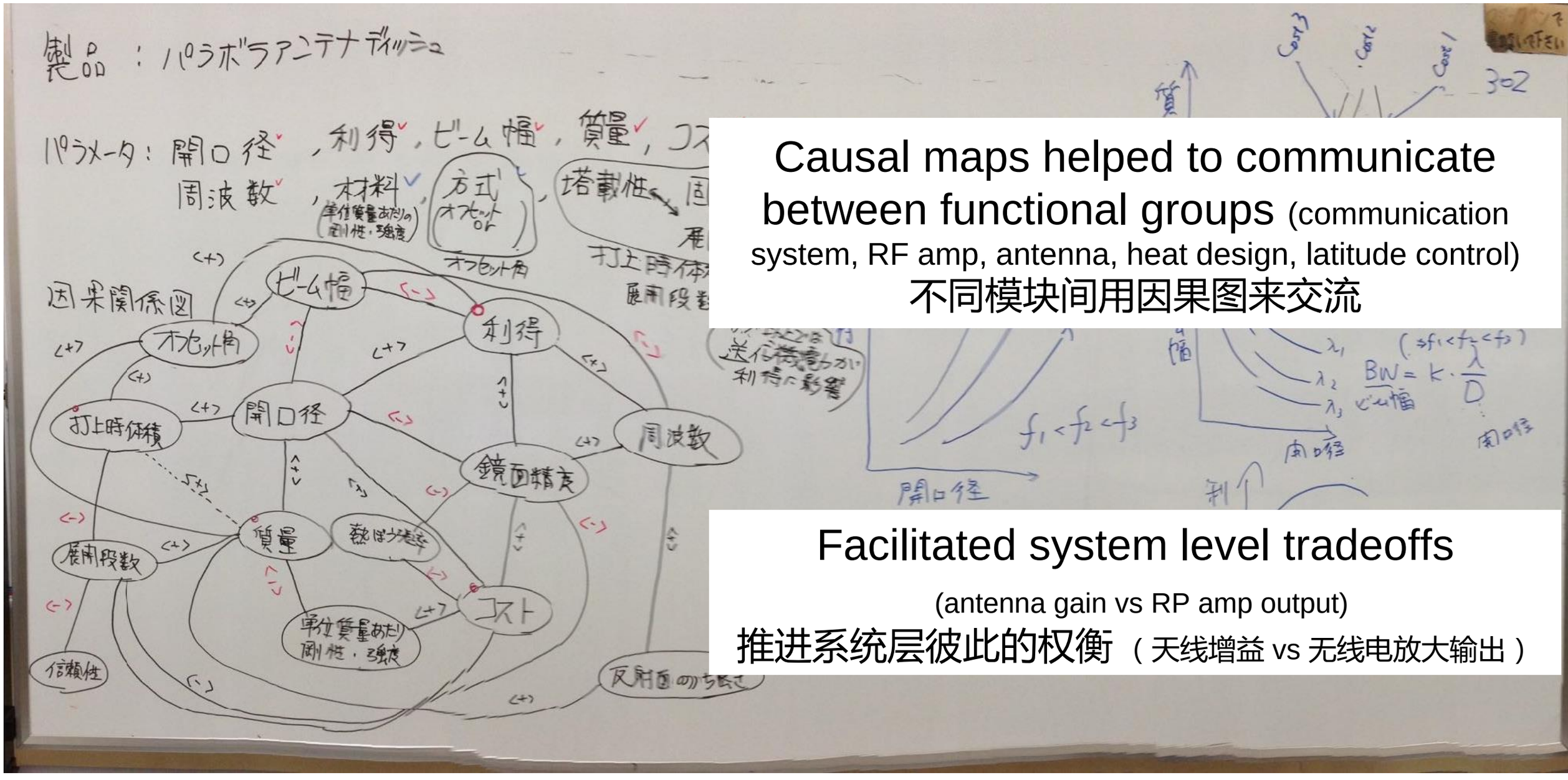


Analogy Thinking for Service Innovation
类比思维在服务创新中的应用案例




大戸屋
OOTOYA

Company N (satellite)
公司N（卫星公司）使用因果图和权衡曲线的案例



Causal maps helped to communicate between functional groups (communication system, RF amp, antenna, heat design, latitude control)

不同模块间用因果图来交流

Facilitated system level tradeoffs

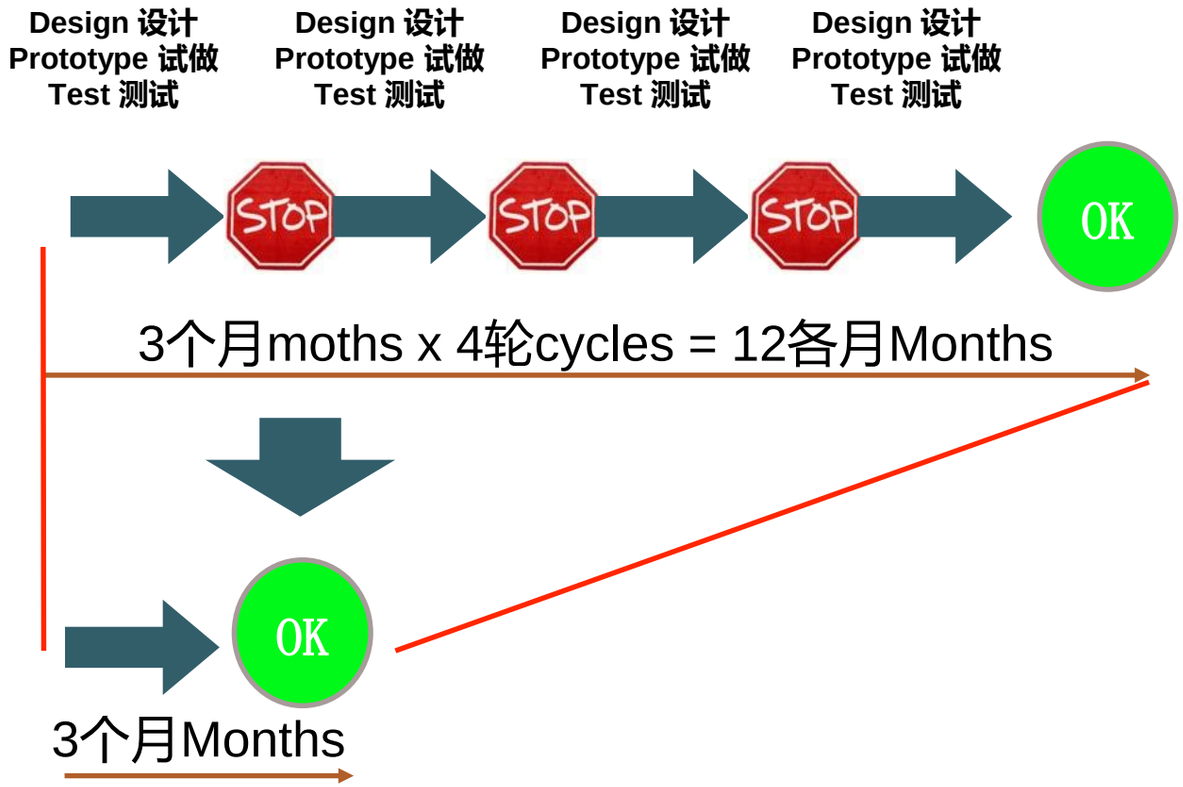
(antenna gain vs RP amp output)

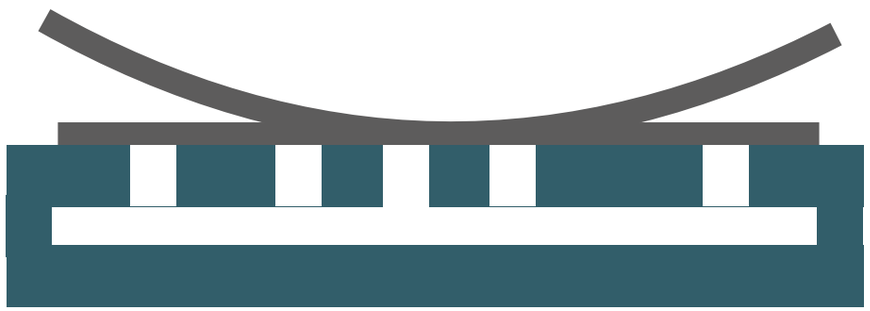
推进系统层彼此的权衡（天线增益 vs 无线电放大输出）

Amazing results of Company JC (Ceramics)
JC公司（工程陶瓷晶元公司）获得的突破性结果

- Engineering ceramics component maker工程陶瓷零件制造商

- Took 12 months (3 month x 4 cycles) to develop new products 用12个月（3个月*4轮）的时间开发新产品





- Reduced development time to 1/4 after 6 months of improvement activities 经过6个月的改进，将开发时间缩短至1/4

How did they develop a breakthrough product at 1/4 the time?
用原来1/4的时间开发出突破性的产品，他们是怎么做到的？

Video of Vacuum Wafer Chuck on their Website
真空硅片夹的视频

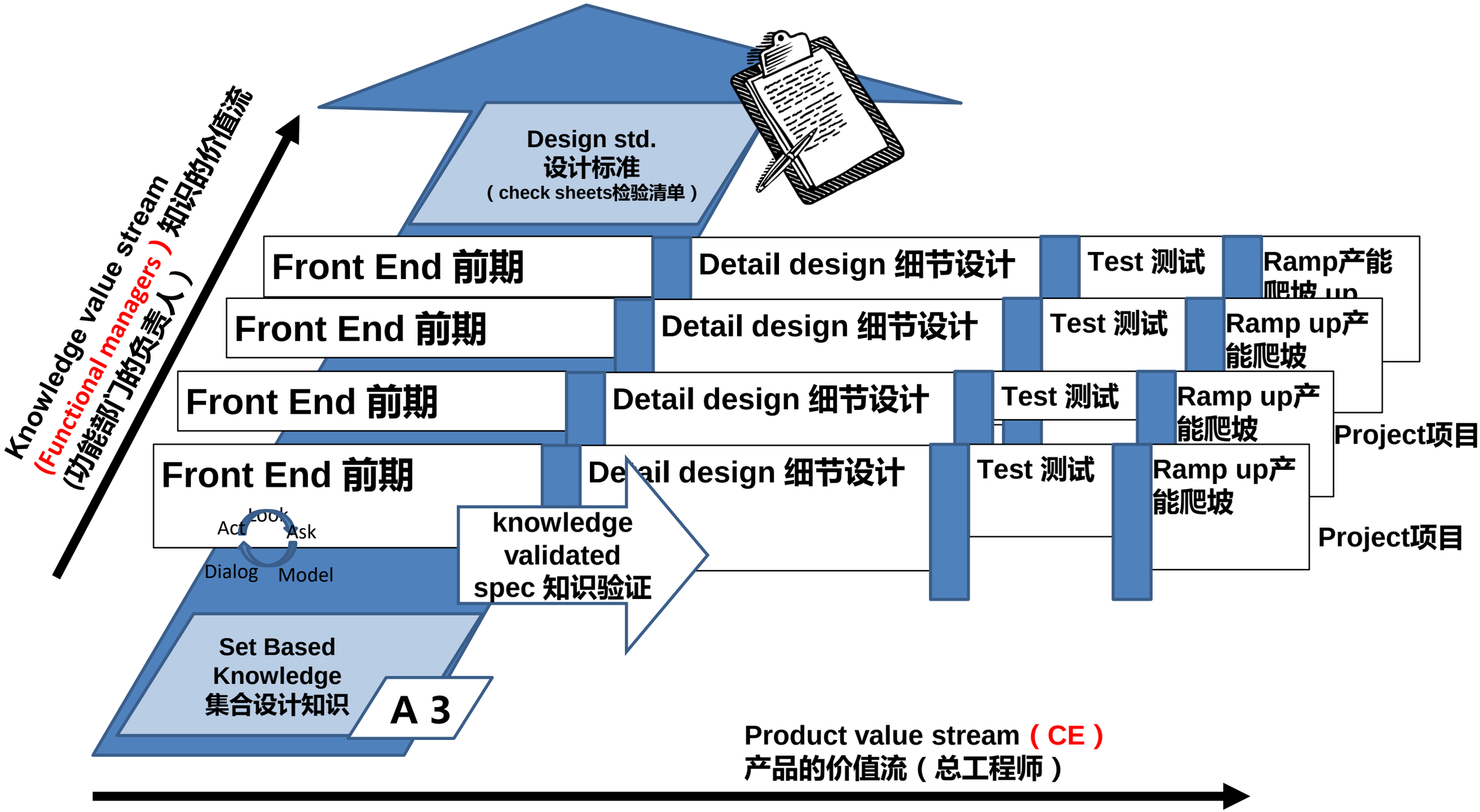
Knowledge re-use, transfer, human development
知识再利用、转移、人才发展

What is the biggest waste in product development?
产品开发中最大的浪费是什么？

Knowledge Gained
获得的知识

- Throw away knowledge gained during development扔掉在开发过程中获取的知识
- All knowledge except drawings remain implicit除了图画，其他知识都隐形了
- Solve the same problem repeatedly重复解决同样的问题

Product and Knowledge Value Streams
产品和知识的价值流



How A3 spread in company JC
JC公司如何应用A3?

- **Engineer director hired from semiconductor company**
  工程总监来自半导体公司

- **Appalled at the lack of knowledge documentation - all the knowledge are being lost!**
  对知识文档的缺乏情况感到震惊——所有的知识都丢失了

- **Told all engineers to write A3s**
  告诉所有的工程师写A3

- **Engineers posted in progress A3s to for peer feedback**
  工程师把A3贴出来，请同事们给反馈

- **Everybody started to see the benefits of A3**
  所有人都开始看到A3的好处

A3 Example: Product A3
A3示例：产品计划

产品计划A3	A3-123456	
检漏机开发		
保密级别		
	审批人：	审批日期：

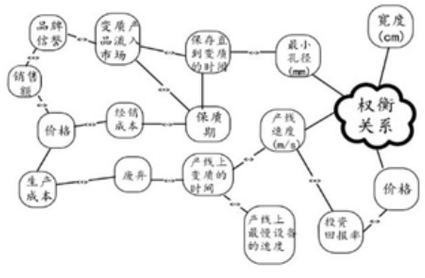
商业目标

-销售目标：$ 20M （第一年）、五年内达到$150M
-利润率：10%以上

客户价值分析

分类	注解	最小孔径 (mm)	产线速度 （米/秒）	设备宽度 （cm）	价格（K$）
喷雾	差异较大	0.09	1.8	100	35
无菌	和乳制品类似	0.10~0.12	1.7	100	差异较大
罐装饮料	差异较大	差异较大	1.7	105	差异较大
乳制品	巨大的市场	0.11~0.12	2.0~3.0	100~120	20~23

乳制品是主要的市场：
- 市场容量大
- 通过平衡速度和检测孔径增加客户价值
- 产品的高性能可以避免陷入价格战

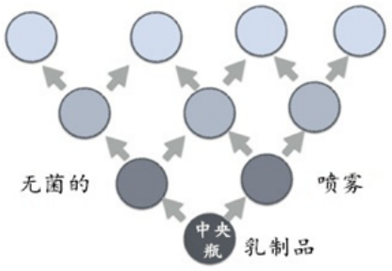


竞争分析

制造商	型号		理由	最小孔径(毫米)	产线速度（米/秒）	宽度（厘米）	价格（千美元）
本-萨尔	TP-200	△	价格高，速度慢	0.12	1.6	160	69
本-萨尔	TP-100	×	孔径太大	0.18	3.0	100	22
太阳	BL-105	×	孔径太大	0.14	2.5	105	23
马科斯	PB-98	◎	最优	0.09	1.8	130	45
US检测机	249	◎	乳制品领域最佳选择	0.12	2.0	100	29

产品策略

保龄球瓶战略：
- 先打入乳制品市场，获得高的市场份额
- 用同一产品打入无菌市场
- 开发新产品打入喷雾市场

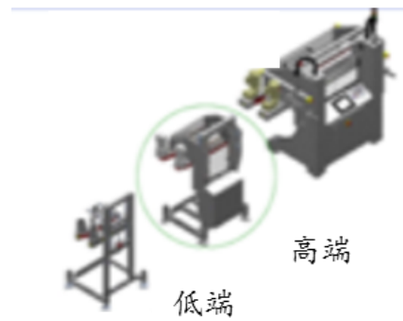


- 销售目标：2000台/4年
- 销售额：2000*60K=$120M/4年
- 开发成本：$5M
- 制造成本：$36K
- 单品利润：$9.6K
- 利润率：16%
- 开发成本回收期：9个月

性能目标

新产品=比高端产品性能好+比低端产品速度快

- 孔径：0.11MM
- 线速度：2-3米/秒
- 宽度：100-110CM
- 重量：200-500KG
- 价格：$25-35K
- 成本：$20-30K
- 利润率：10%



概念设计阶段的知识缺口

1 如何移动权衡曲线
2 如何达到目标成本

总体计划

	人月	预算		计划
概念设计	12	1530		————
详细设计	20	5500		————
生产准备	18	14500		————

A3 reports: easy to explain, difficult to write
A3报告：容易理解但难于撰写

- Can’t summarize 无法总结
- Can’t decide what’s important 无法决定哪个重要
- Don’t know what the essence is 不知道核心点是什么
- ……

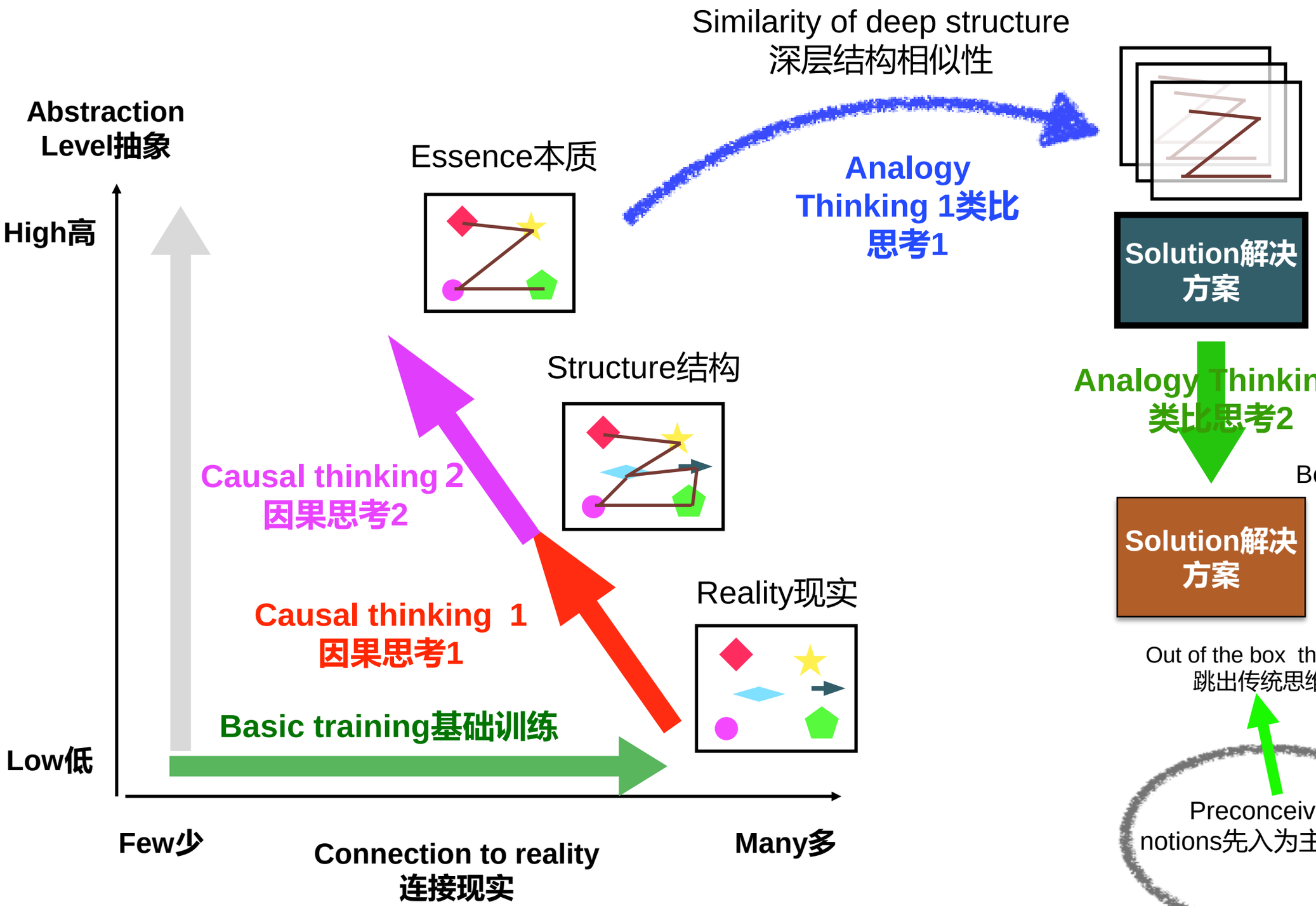
Lack of Essential Thinking
缺乏本质思考

mental ability to distill the essence
萃取关键信息的思维和能力

Essential Thinking Training
本质思考

- 阶段1（Stage 1）: Basic training 基础训练
- 阶段2（Stage 2）: Causal thinking training -1 因果思考训练-1
- 阶段3（Stage 3）: Causal thinking training -2 因果思考训练-2
- 阶段4（Stage 4）: Analogy thinking training -1 类比思考训练-1
- 阶段5（Stage 5）: Analogy thinking training -2 类比思考训练-2

Essential Thinking Training
本质思考训练



Tools used and effectiveness
不同公司实践精益产品开发工具的情况和效果

Company 公司	Start year 起始年	JTBD	Set based dev. 集合设计	Fast experiment 快速试验	A3	Essential thinking 本质思考
O RF device 无线电设备	2014	☑✓	☑✓		✓	✓
JC Ceramics JC陶瓷	2014	☑	☑✓	☑✓	☑✓	☑
N satellite卫星	2013		✓		☑	☑
EA Software 软件	2015	☑			☑✓	☑✓

☑ tool introduced
工具引进

✓ tool used well
工具使用良好

☑✓ tool used very effectively
工具使用很有效

Major Factors for Success in LPD Implementation
精益产品开发落地的关键成功因素

- **Top management support (long term view)**

  从长期看，高层的支持非常关键

- **Right Sensei (someone with experience to lead the journey)**

  合适的导师（有足够经验引导整个过程）

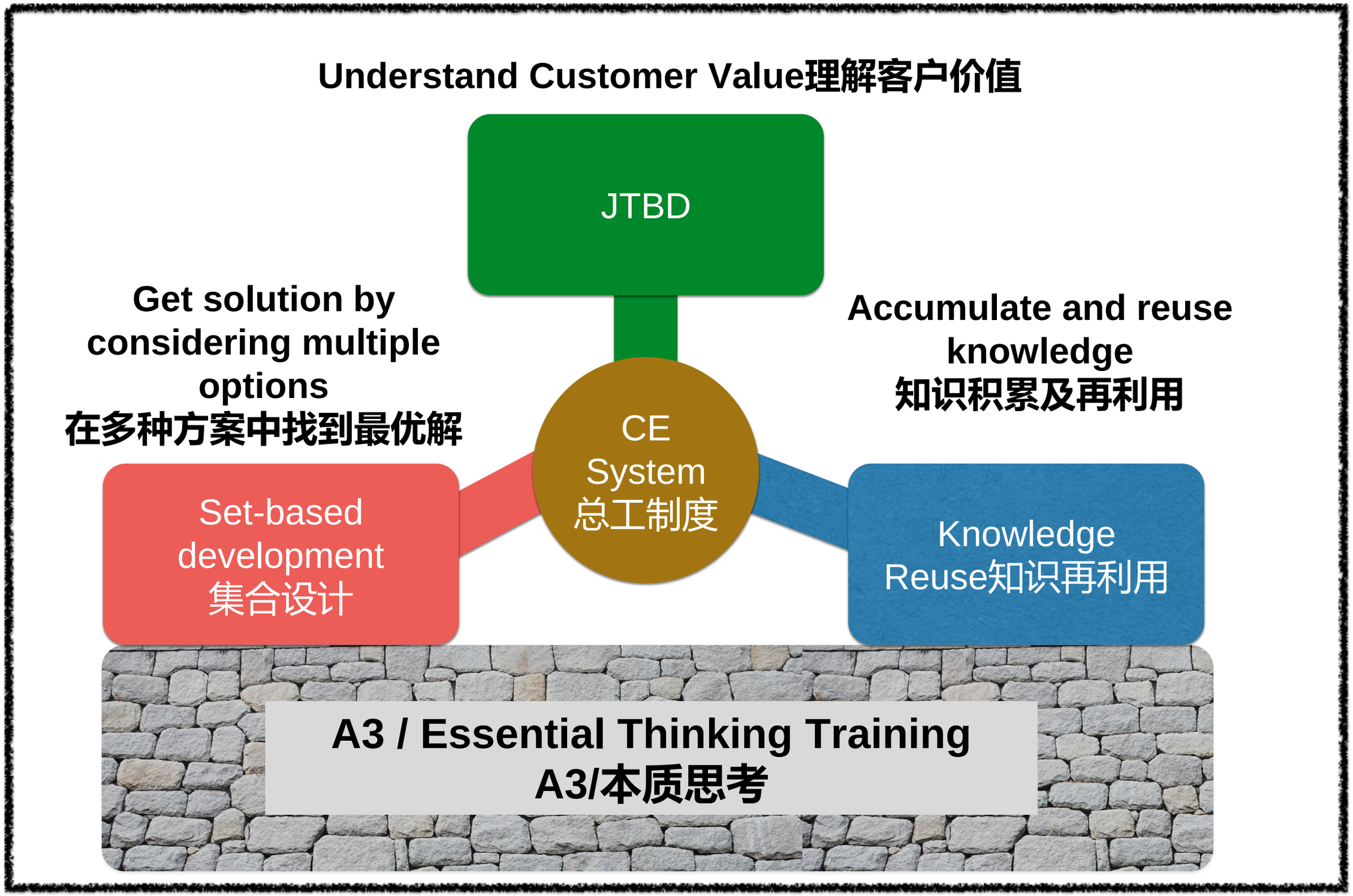
- **Use key elements：JTBD (Jobs to be done), Set based development, fast & cheap experiment, Knowledge reuse, Essential thinking training**

  核心方法掌握（JTBD、集合设计、快速及低成本的试验、知识再利用、本质思考）

- **Right organizational size：Too big to change, too small to be of consequence**

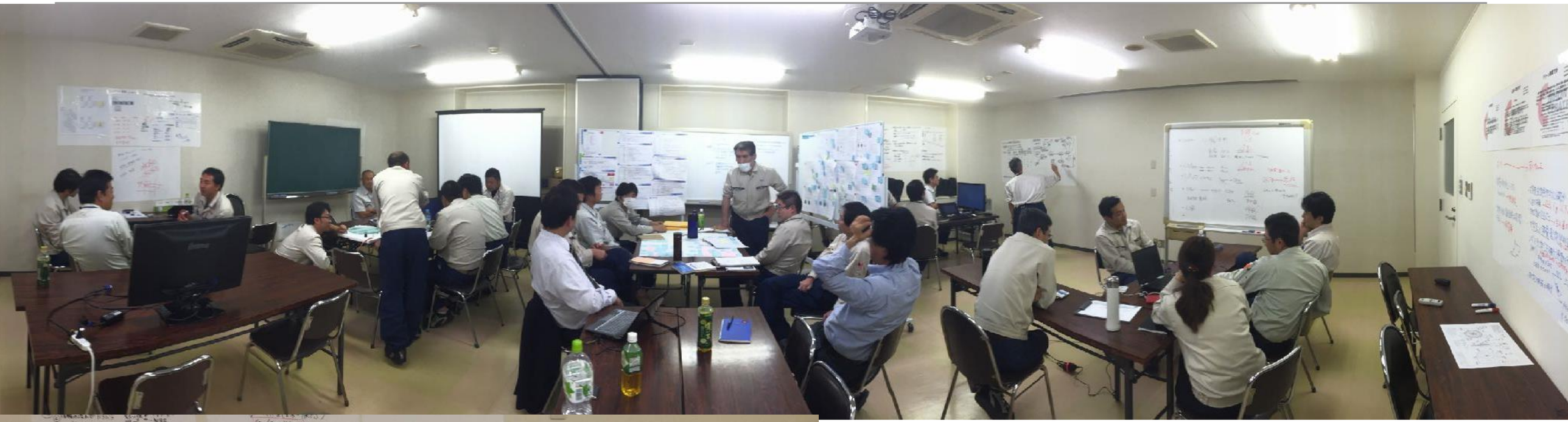
  合适的组织规模：太大的公司不容易变革，太小的公司体系化的意义不大。

Review：Major Components of LPD
回顾：精益产品开发（LPD）的整体框架



Thank you for your attention!
谢谢聆听！

Super-work Shop Method at Company JC



- 2 days/ month
- All projects in one room
- 2 hour lecture
- 1 hour team presentation - share results

Company JC
Covered from wall to wall with A3s

Company N (Satellite systems)

- Introduced TPS in 2010 with promising results
  Started LPD in 2013 for 200+ engineers

- Training on set based development, causal maps,
  Deep and Fast Thinking

- Consultant participated in early design reviews
  and prevented several large loopbacks