



Product Design

Session 3 – “Far Horizon” (i.e., Horizon 3) Innovation

Professor Karl T. Ulrich
Vice Dean of Entrepreneurship & Innovation

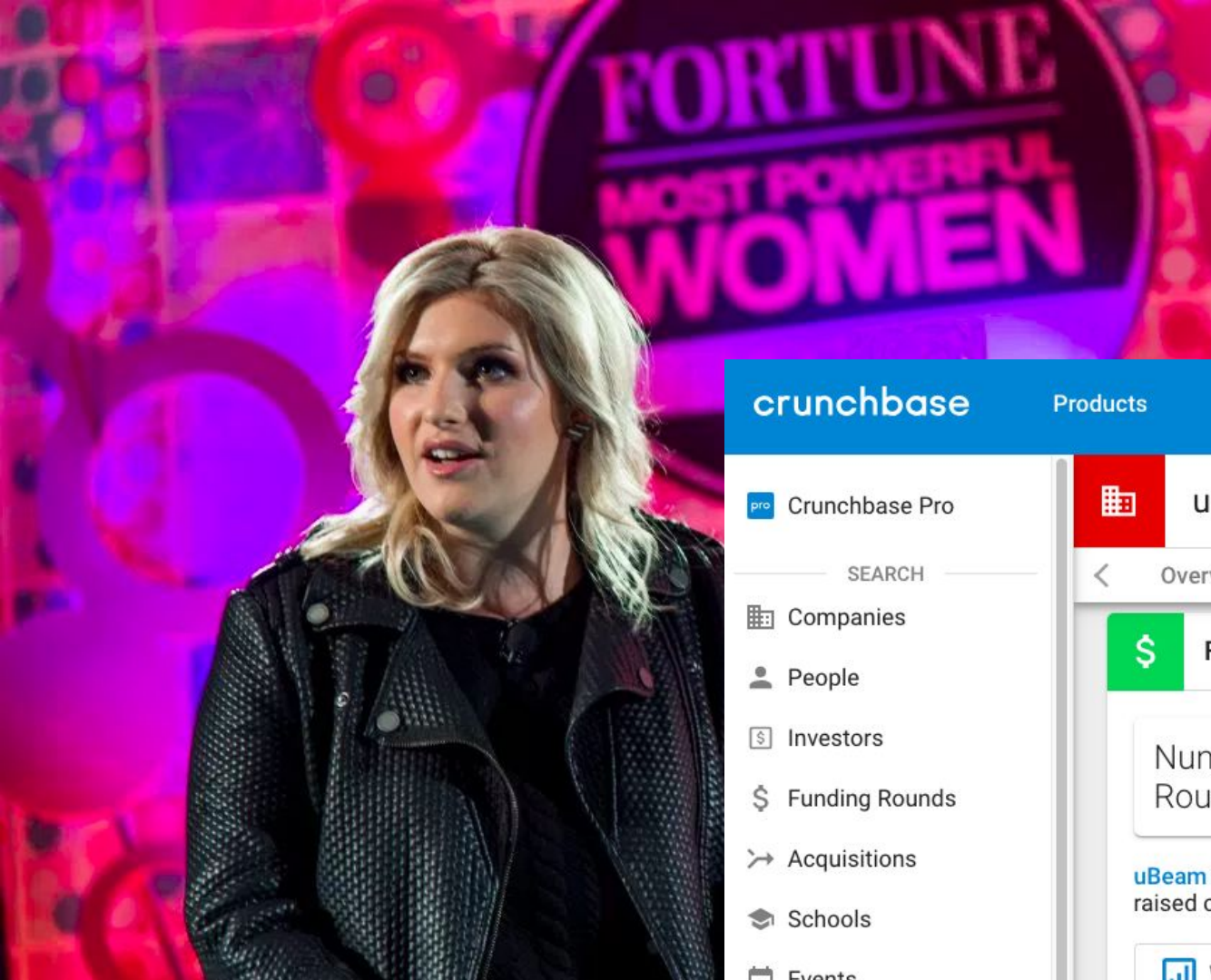
@ktulrich | ktulrich.com | ulrich@wharton.upenn.edu

Meredith Perry C11



"You know how we have wireless for connecting to the internet? I want to use ultrasound to do that for electric power."

Meredith to Karl 2011



Peter Thiel Marissa Mayer
Mark Cuban Andreessen Horowitz

crunchbase

ProductsMarketplaceNewsAbout

Crunchbase Pro

SEARCH

Companies

People

Investors

Funding Rounds

Acquisitions

Schools

Events

uBeam

OverviewUnlock ChartsFunding Rounds

\$

Funding Rounds

Number of Funding Rounds5

Total Funding Amount

uBeam

has raised a total of **\$31.7M** in funding over **5** rounds raised on **Nov 15, 2017** from a **Series B** round.

Which funding types raised the most money?



Got a tip? [Let us know.](#)

Follow Us [f](#) [i](#) [t](#) [v](#) [F](#) [in](#) [g+](#) [RSS](#)

[News](#) [Video](#) [Events](#) [Crunchbase](#)

[Message Us](#)

[Search](#)



10TH ANNUAL CRUNCHIES AWARDS Final 2 Days To Save On Crunchies Tickets [Get Yours Now](#)

Wireless Charging

uBeam

Drama

Popular Posts

SPONSORED CONTENT

Sponsored By [Verizon Wireless](#)



The Most Impressive Car Tech That Rolled Out At CES



Doug shows you how to get rid of Amazon Fresh totes
3 days ago



GM and Honda partner to mass produce hydrogen fuel cells in Michigan

Wireless charging startup uBeam accused of being the next Theranos

Posted May 11, 2016 by [Josh Constine](#) (@joshconstine)



2019 updates:

<https://liesandstartuppr.blogspot.com/>

[Next Story](#)



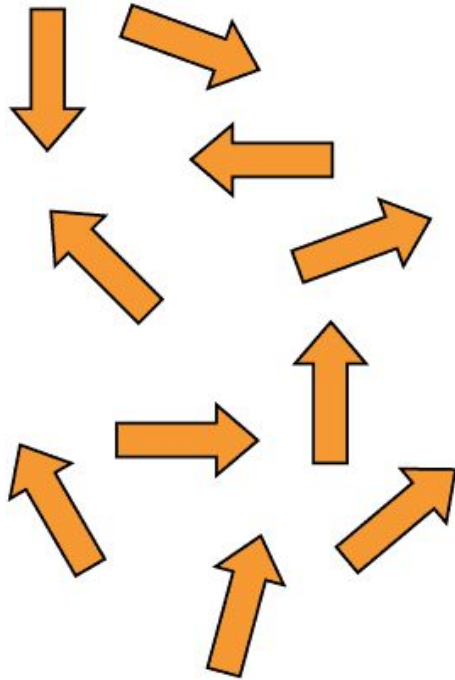
Enjoy the freedom of the best network.

Limited time only.

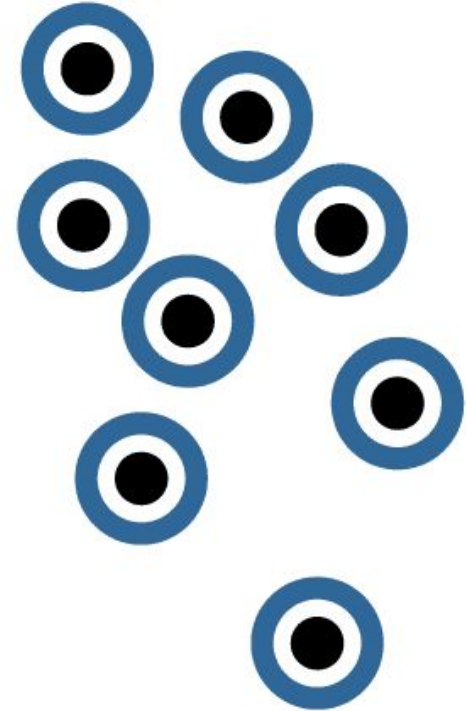
[Learn more >](#)

innovation

A new match between a *solution* and a *need*.



i.e., *product-market fit*



How to Categorize Innovation?



Google Glass

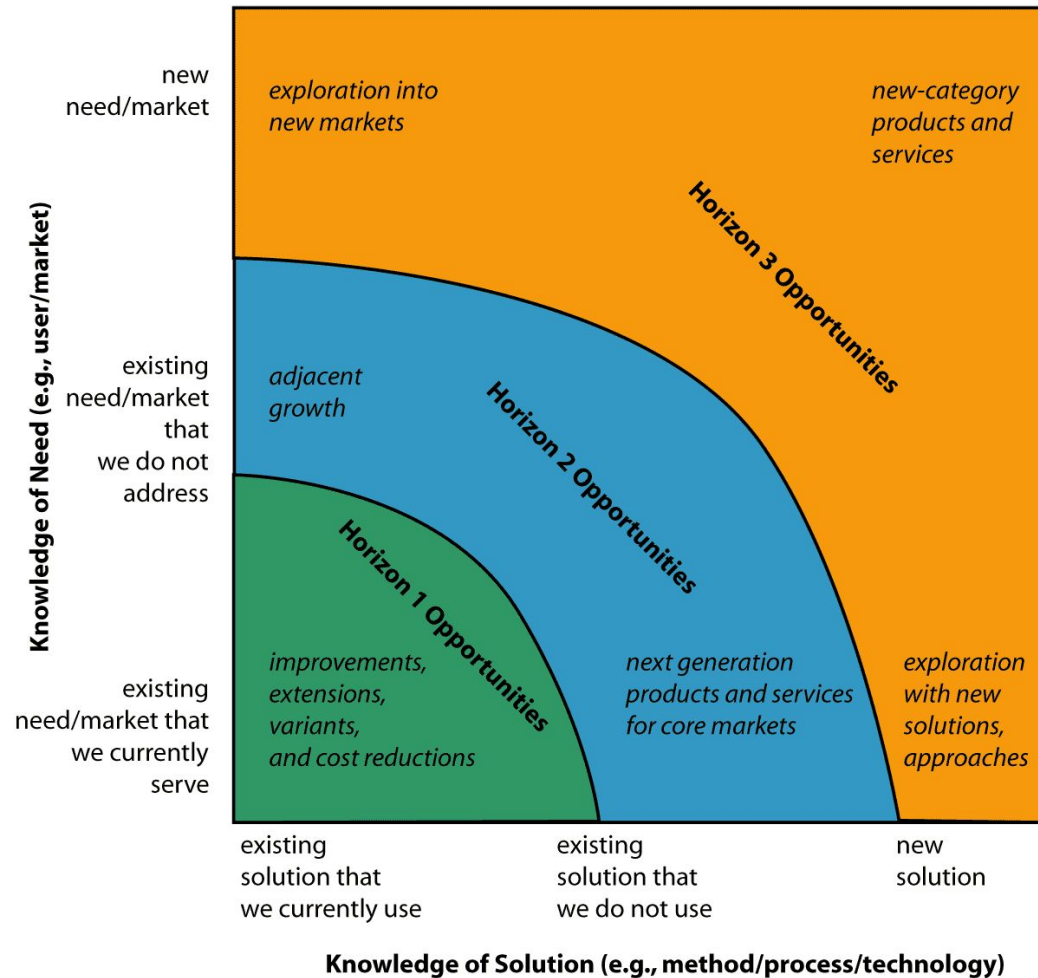


Reconfigurable, modular mobile device



Reversible USB cable

Categorizing Innovation from Perspective of an Established Firm



Source:
Terwiesch and Ulrich,
Innovation Tournaments.

“Need” is Broadly Defined

“We wanted flying cars,
instead we got 140
characters.”

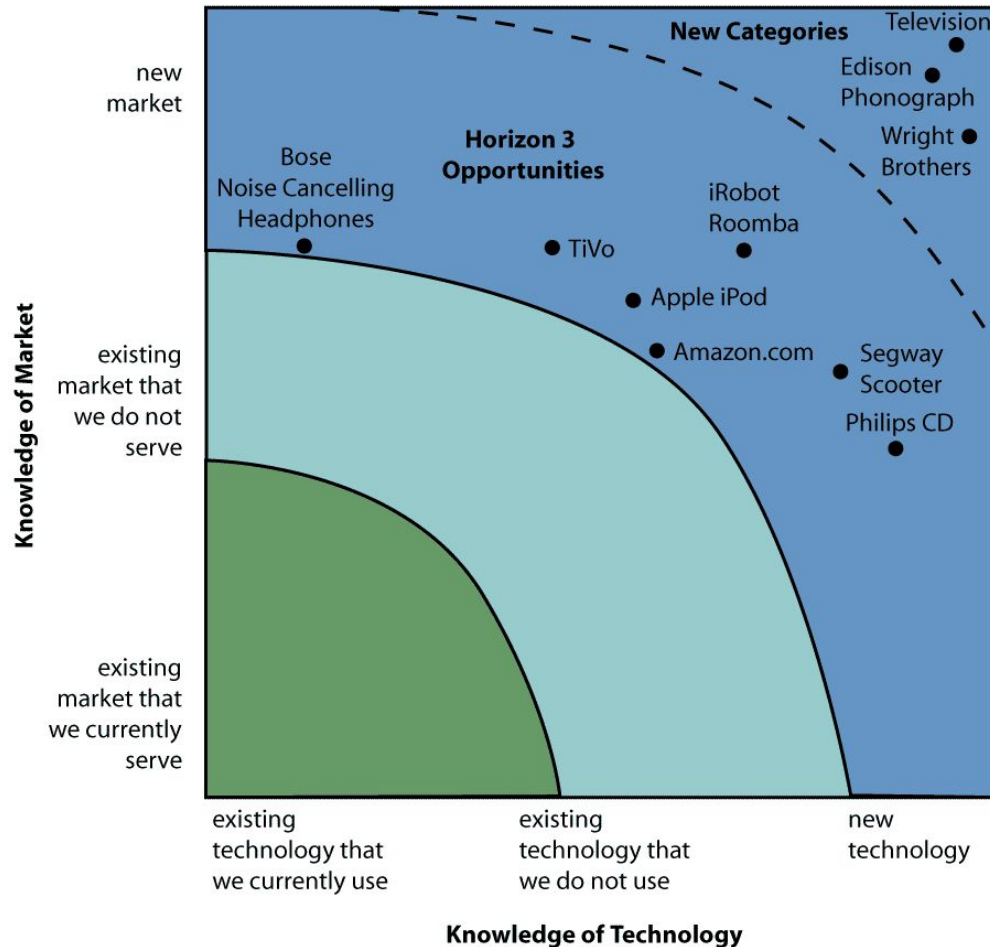
Peter Thiel
Founders’ Fund





Carl Dietrich
CEO Terrafugia

New Categories are Usually Established by New Entrants



Playing out now:

Peer-to-peer transport (Uber)
Quantified self (Fitbit)
3D Printing (3D Systems)
Personal robots (iRobot)
Personal transport (Segway)
Flying cars (Terrafugia)
Cryptocurrency...tbd
Autonomous vehicles...tbd
Wearable computing...tbd
AR/VR...tbd

Source:
Terwiesch and Ulrich,
Innovation Tournaments.

OCTOBER 24, 2013



CTO at Segway where he reported to visionary Dean Kamen. Before that he spent time at DEKA Research & Development Corp., Johnson & Johnson Medical Inc. and got his education at Massachusetts Institute of Technology and Purdue.

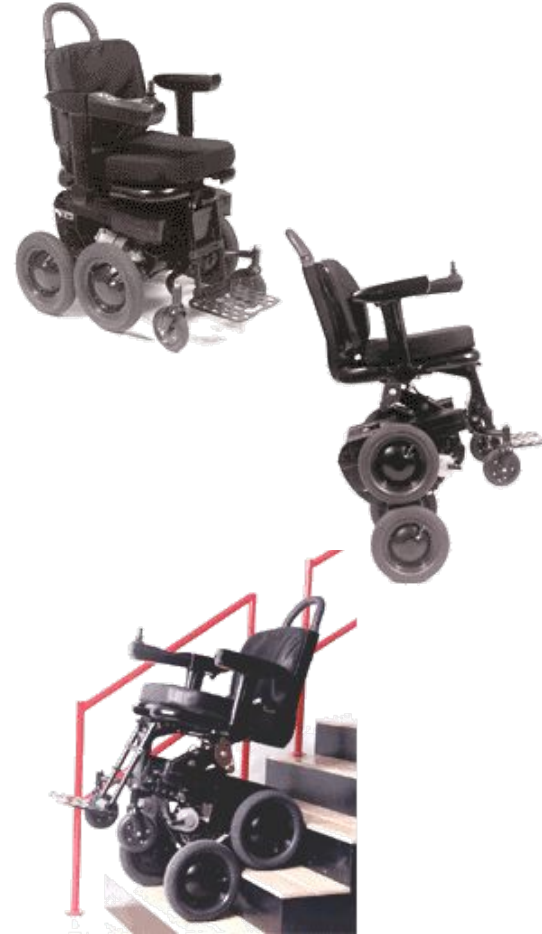
"Doug has demonstrated the leadership and technical talent to develop and deliver outstanding products, including what are widely considered the best computers in the world," said Elon Musk, Tesla co-founder and CEO. "Tesla's future depends on engineers who can create the most innovative, technologically advanced vehicles in the world. Doug's experience in both consumer electronics and traditional automotive makes him an important addition to our leadership team."

[More at 9to5mac](#)

TESLA HIRES APPLE VP DOUG FIELD TO LEAD VEHICLE PROGRAMS

THURSDAY, OCTOBER 24, 2013

iBot Self-Balancing Wheelchair





Dean Kamen
Founder & CEO
Deka Research

Source:
U.S. Government, Whitehouse



\$80 mm investment by Kleiner-Perkins, CSFB

Specifications:

- 12.5 mph
- 80 lbs
- 11 miles range
- \$9000
(consumer version \$4950)

Original volume projections:
40,000 units/month by end of 2002.

"I would stake my reputation, my money and my time on the fact that 10 years from now, this will be the way many people in many places get around. If all we end up with are a few billion-dollar niche markets, that would be a disappointment. It's not like our goal was just to put the golf-cart industry out of business"

– Dean Kamen

<launch video>

Purchase Intent Survey

If the Segway HT Consumer Model were available from a retailer near you, and were priced at \$4995, how likely would you be to buy the product within the next 12 months?

definitely
would not
buy

☐

probably
would not
buy

☐

may or
may
not buy

☐

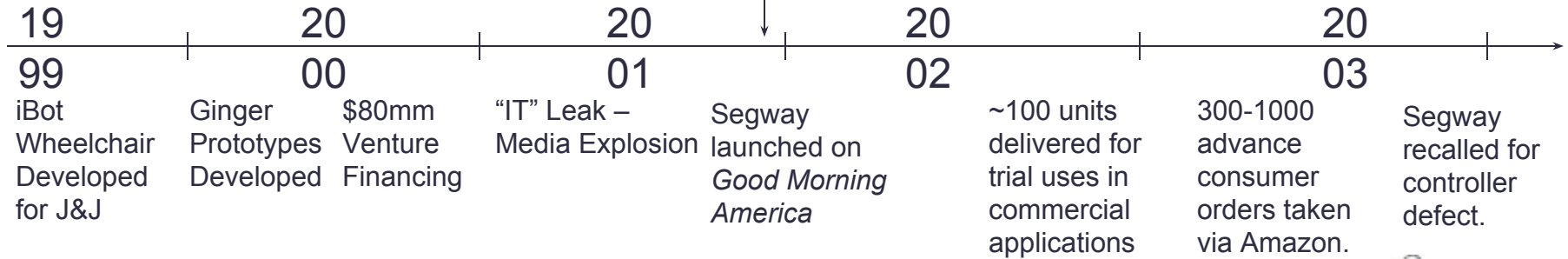
probably
would
buy

☐

definitely
would
buy

☐

Segway Timeline



"The question isn't whether people will buy it. The question is whether or not the government will let them use it."

-Steve Jobs
Advisory Board
Member

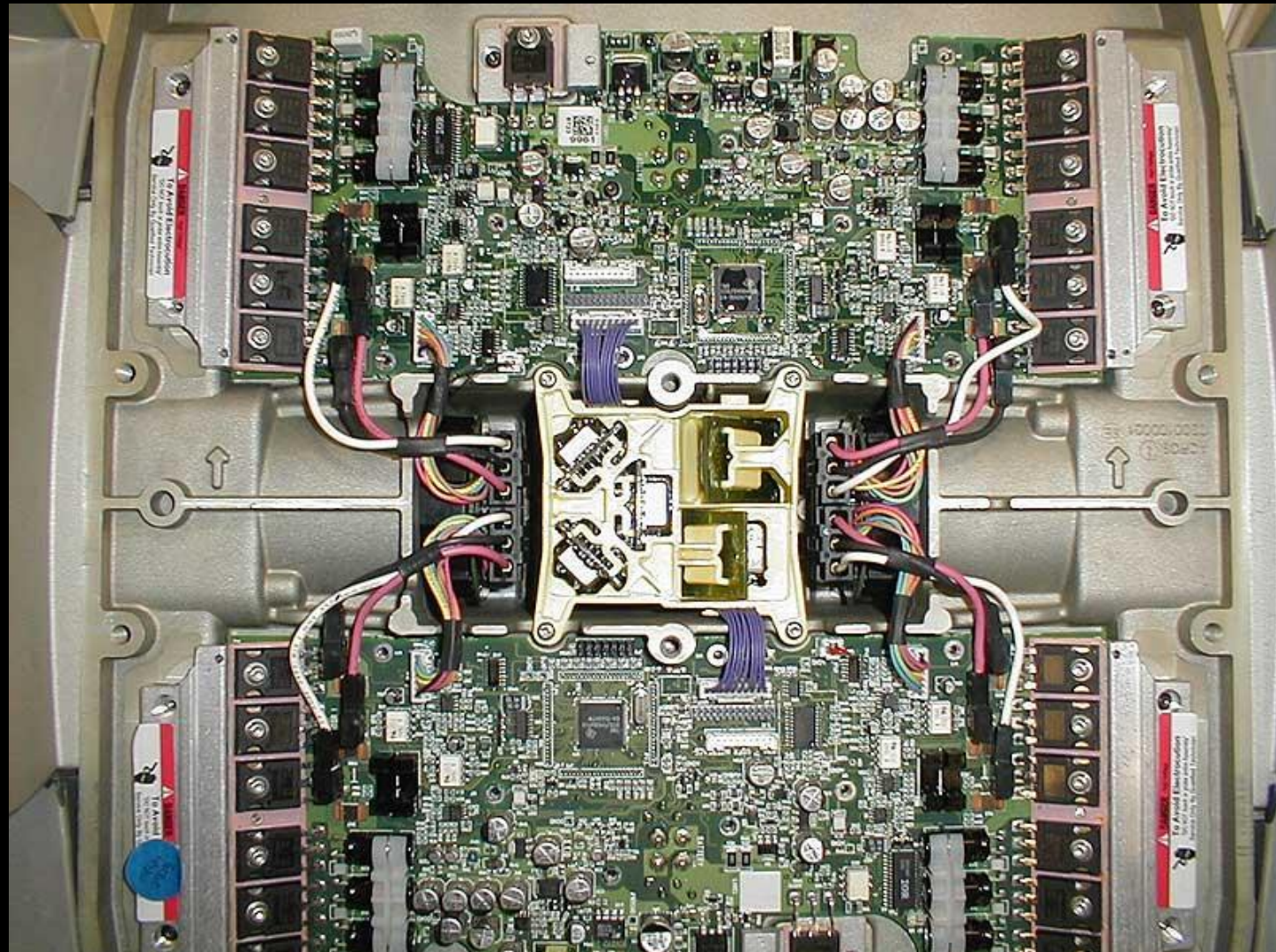


Amazon Exclusive!!
Order a Segway now!
It's only at Amazon

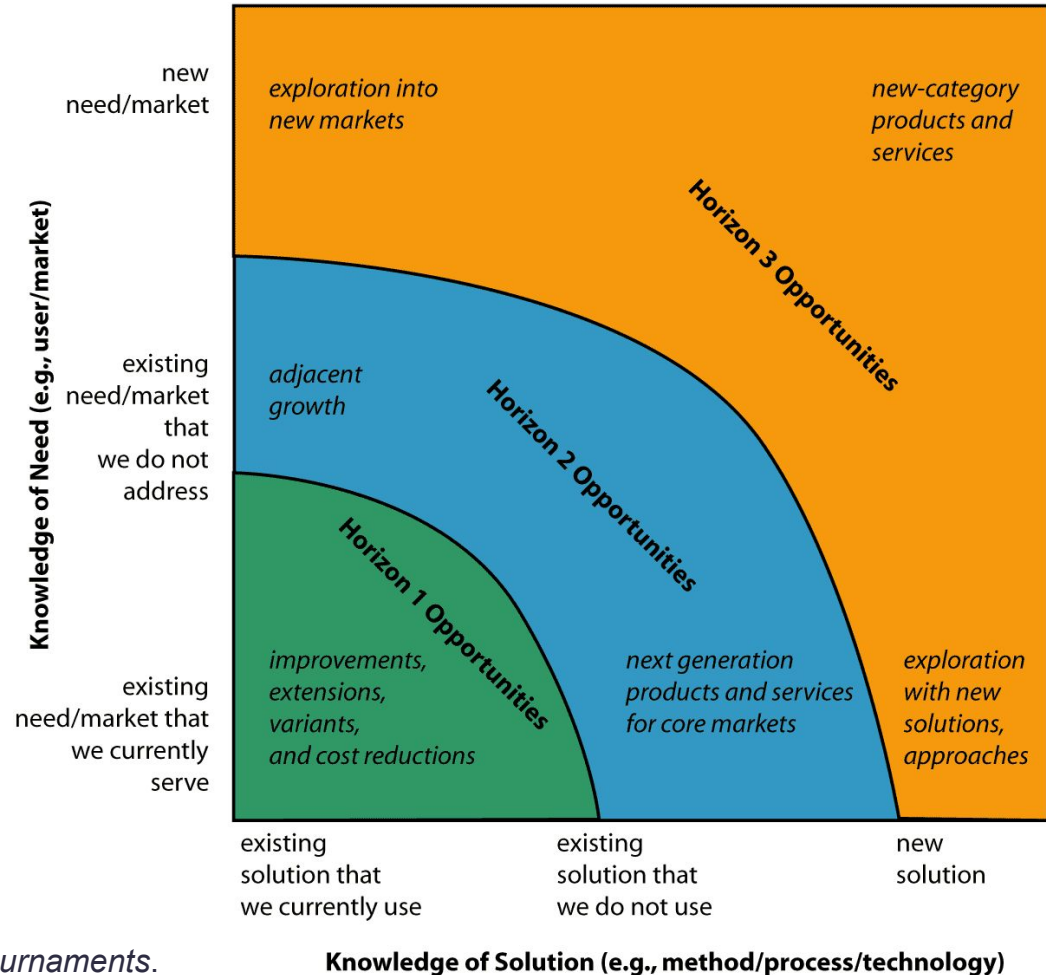


Management
replaced
(twice)

Total sales first
two years
~5000 units.



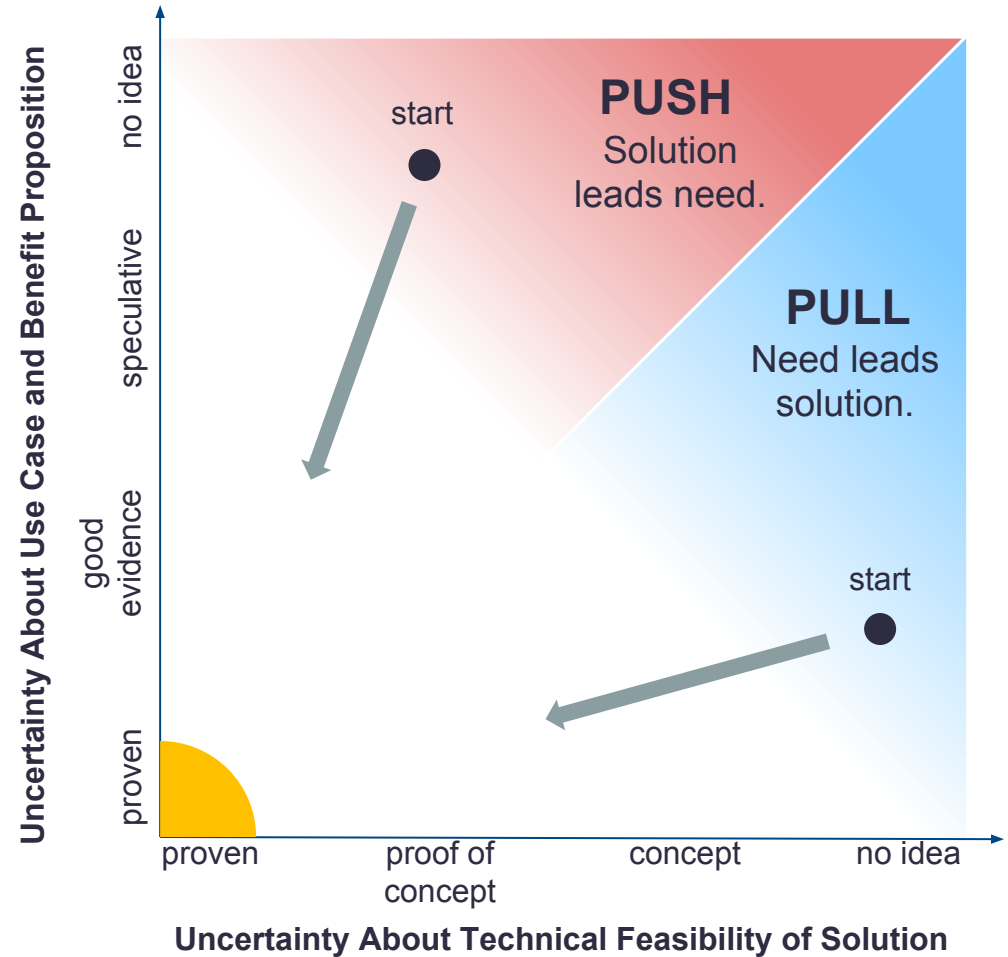
Categorizing Segway from Perspective of DEKA Research



Push vs. Pull



iBot self-balancing wheelchair

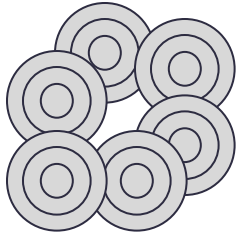


The Wright Brothers Had No Customer or Market



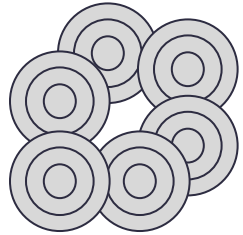
Source: US Library of Congress via Wikimedia Commons

“Push” in New Categories



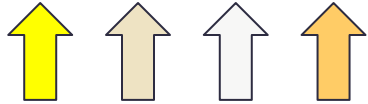
Consensus in scientific/technical community about major opportunities

e.g., human flight, driverless cars, longevity, space travel, nano-robots
The Need is “obvious” but the specific use cases are vague, because there is no user experience.



A solution is **pushed** into the world by an enthusiast, possibly for his/her own use.

- Market develops slowly.
- Niche applications.
- May be too expensive, unreliable, hard to use.
- Doesn't really hit target.



Others try.



Sometimes a big market emerges in combination with the right version of the solution.

The Push Paradox

Radical innovation tends to be pushed into the market by technology enthusiasts.

Yet, those enthusiasts will rarely (a) get it right, (b) have the relevant capabilities to exploit the innovation, and/or (c) have the patience/resources to survive the adoption process.



The Risk of Technology Push

Market Opportunity
(the “NEED”)



Technological
Concept
(the “SOLUTION”)



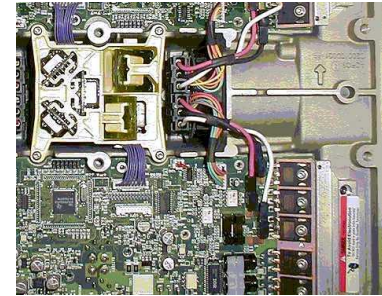
2 lateral wheels +
Dynamic stabilization

?



3 wheels – tripod +
“Throttle”

Inherent Cost
Structure



Active fault tolerance
Twin drive
Sensing and controls
Power management
Asymptotic cost = \$1500?

Single drive
Trivial controls
Inherent passive fault tolerance
Asymptotic cost = \$400?

Search for:

You are here: [Home Page](#) > [Toys](#) > [Bikes & Scooters](#) > [Electric Scooters](#)

Rad2Go: The Q Personal Transporter



\$994.00

Preorder this item today and it should arrive on or just after 12/29/2003

Shipping Cost: To see the shipping cost for this item, add it to your cart.

[Preorder](#)

Save gas money and travel time with The Q, a Quick, Quiet and Quite affordable personal transporter by Rad2Go. Great for college campuses, warehouses and short commutes, this lightweight vehicle allows you to step on and go! With a maximum speed of 10 mph and the ability to fold up for portability and storage, you can ride it to the train station or subway, fold it up and travel with ease. It's like having your own personal moving sidewalk.

[See larger photo](#)

Click on an image to enlarge it:







Photo: Jesse Follow

IAAF World Championships

Daegu 2011



DAEGU STADIUM

IAAF World Championships Daegu 2011



SEGWAY® BLOG

A Blog About Business, Technology, Being Green and All Things Segway

Segway Announces Development of a Three-Wheel Personal Transportation Device for the Public Safety Market

Segway Quality, Value Priced Product will be Available in Q4 2013

Bedford, New Hampshire – March 6, 2013 – Segway Inc. (Segway) is pleased to announce the development of a new three-wheel personal transportation product targeted at the public safety market.

"Our customers are demanding a feature-rich, quality-made three-wheel device that is value priced. We are going to meet their needs and deliver that product by the end of this calendar year," said Roger Brown, President and Chief Executive Officer, Segway Inc.

Brown added, "Segway is a green personal transportation company. Our mission is to move people from point a to point b in a safe and highly-efficient manner. One element of our strategic and aggressive business plan is to grow our product portfolio by thoughtfully conceiving, designing and launching new and affordable products that meet customers' needs and complement our current product offerings."

The new three-wheel transportation solution will be electric and boast zero emissions. Police and security customers will appreciate its design, reliability, visibility, versatility and most importantly, its competitive price of \$7,500*. They will also enjoy the benefit of a world-class international service network.

Availability

ZERO DOWN LEASING AVAILABLE™



Personal Transportation Robot

[Watch the video](#) 



April 2015

Ninebot acquires Segway.

Segway had sued for patent infringement.

Ninebot closed \$80mm investment from Xiaomi and Sequoia.

KU Guess: \$30-40mm price for Segway.



Click to open expanded view

Segway miniPRO | Smart Self Balancing Personal Transporter with Mobile App Control

by Segway



455 customer reviews

| 427 answered questions

List Price: \$1,299.00

Price: **\$798.00** FREE Shipping for Prime members [Details ▾](#)You Save: **\$501.00 (39%)****In Stock.**Sold by [Segway Distribution - North America](#) and [Fulfilled by Amazon](#).Color: **Black****\$798.00**

Prime (4-5 days)

**\$798.00**

Prime (4-5 days)

- Connect to the free mobile app via Bluetooth for full features: remote control operation, anti-theft alarm, speed control, customizable lights, vehicle diagnostics, and firmware updates
- UL 2272 Certified unit meets high standards of fire and electrical safety set by world-renowned global safety science company Underwriters Laboratories
- 220 lbs payload, light-weight, and durable aircraft-grade magnesium alloy frame and 10.5-Inch pneumatic air-filled tires with military-grade shock absorption capability
- Dual motor engine delivers 1600 watts of power to safely reach top speeds of 10 MPH and distances of 14 miles on a full charge in a variety of indoor and outdoor terrains.
- Padded knee bar maximizes comfort and enables precision steering for more ergonomic control than hoverboards and electric scooters that rely on foot-pivot steering







Startups

Apps

Gadgets

Events

Videos

—

Crunchbase

Advertise

More

Search 

Gift Guide 2018

Fundings & Exits

Apple

Asia

Lime partners with Segway to build electric scooters



Megan Rose Dickey @meganrosedickey / 7 months ago



Comment

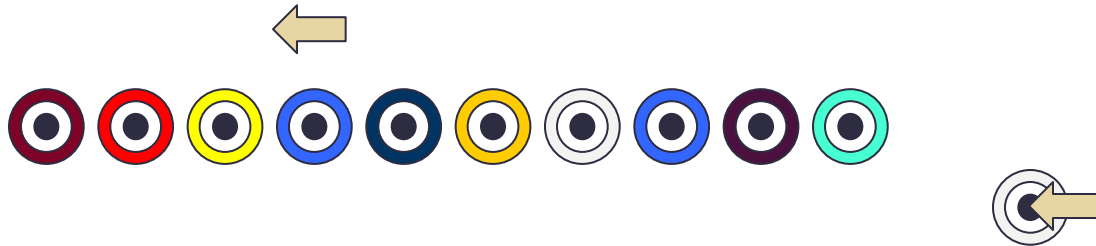


Disciplined Approach to Tackling “Push” Innovation

1. For each hypothetical use case (“need”) identified for your solution, consider
 - How might a smart innovator attack this problem if they were to pull from the need.
 - Is my solution better than what a great team taking a “pull” approach might develop?

Push

What can we do with our solution?



(and... is our solution the best possible solution?)



Disciplined Approach to Tackling “Push” Innovation (continued)

2. Identify a beachhead market (high need, high willingness to pay)

- Use early prototypes to validate and refine solution.
- Launch a minimum viable product.
- Iteratively refine to find product-market fit.
- Expand to adjacent markets as price-performance improves.



How *minimum* your MVP can be depends on category!

Disciplined Approach to Tackling “Push” Innovation (continued)

3. Carefully sequence tasks to reduce the most uncertainty at the lowest cost

Timing of Key Problems Tackled by Segway LLC

\$50mm+
2000-2001

Technical performance

Production capacity

Reliability and robustness

Legality

Patents

Staffing a large organization

\$??
2002

Where to ride

Which markets

What price point

Demand forecast

What benefits

Purchase Intent Survey

If the Segway HT Consumer Model were available from a retailer near you, and were priced at \$4995, how likely would you be to buy the product within the next 12 months?

definitely
would not
buy

☐

probably
would not
buy

☐

may or
may
not buy

☐

probably
would
buy

☐

definitely
would
buy

☐

Lia



Bethany Edwards IPD14

Far Horizon Innovation – Know What You Are Getting Into

- Fun!
- Very, very risky. Base rate of success <25%.
 - Best with OPM (“other peoples’ money”)
 - As employee of established organization.
 - Drawing some salary from outside investment in venture.
- Offers promise of developing highly valuable intellectual property, most likely primarily *know-how*.
 - But, most of the time, the pioneers do not develop into the eventual market leaders.

Design Thinking: Watch out for the Push!

IWWMW... build a wall?

vs.

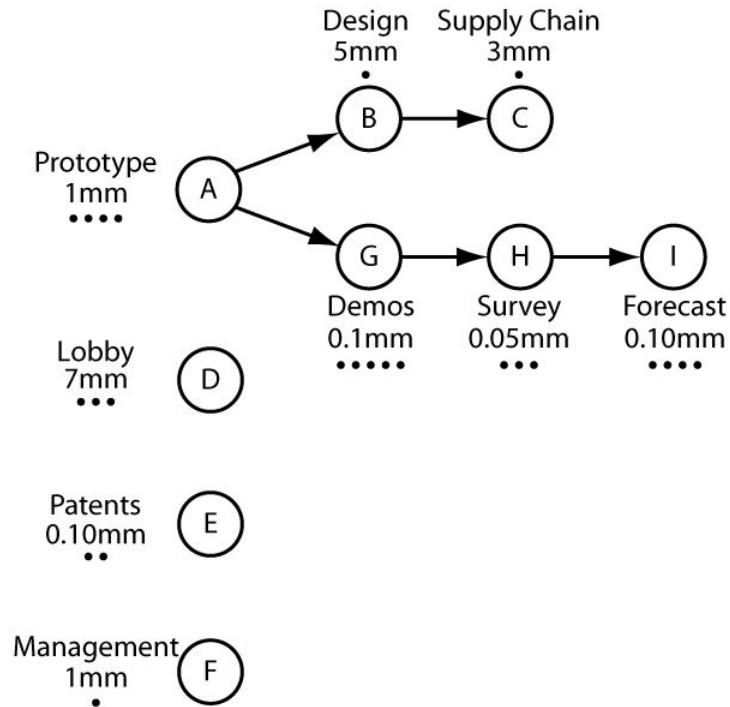
IWWMW... manage immigration consistent with law and values.



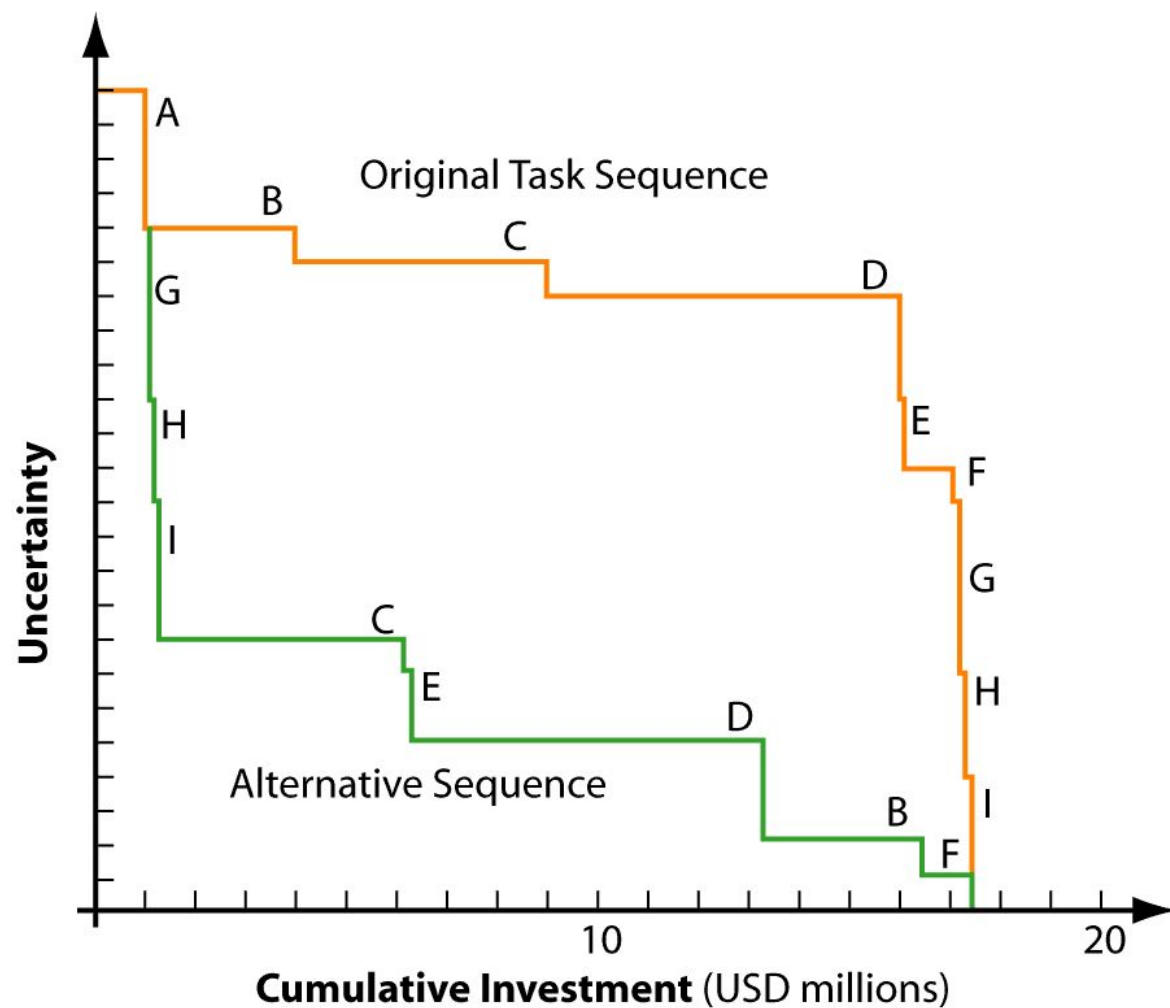
	Task	Questions Addressed	Effect on Uncertainty	Cost of Task (USD)
A	Complete alpha prototype design, fabrication, and testing.	Will the technical performance of the product be acceptable?	• • • •	1 mm
B	Design supply chain and set up production facility.	Can we establish production capacity?	•	3 mm
C	Complete production-intent design, engineering refinement, life testing.	How reliable and robust can we make the product?	•	5 mm
D	Lobby for new legislation in state and local governments.	In how many states will it be legal to ride on the streets and sidewalks?	• • •	7 mm
E	File patents.	What is the extent of the intellectual property barrier?	• •	0.10 mm
F	Recruit full management team of new company.	Can we establish the structure and personnel to support a large enterprise?	•	1 mm (+0.50mm/ month)
G	Conduct customer interviews and demonstrations.	Which market segments will most resonate with the benefits of the product? What is the core benefit proposition for the product? Where will the user ride the product?	• • • • •	0.10 mm
H	Perform competitive product analysis, customer surveys, retailer surveys.	What should be the target price point?	• • •	0.05 mm
I	Complete diffusion modeling, historical comparisons, purchase intent survey.	What is likely to be the sales trajectory?	• • • •	0.10 mm

Source: Terwiesch and Ulrich, Innovation Tournaments, Chapter 8.

Tasks and Inherent Dependencies



Source: Terwiesch and Ulrich, Innovation Tournaments, Chapter 8.



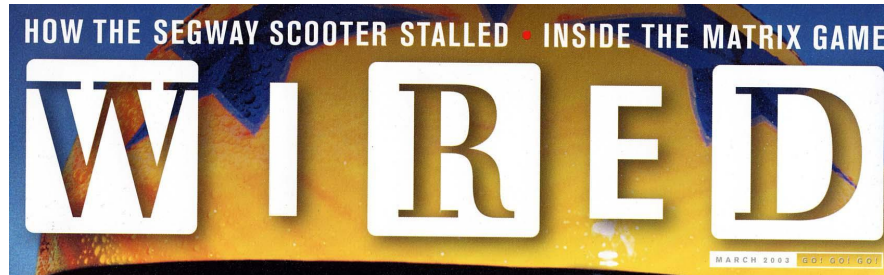
Source: Terwiesch and Ulrich, Innovation Tournaments, Chapter 8.

Forecasts of New-Category Ventures Often Wildly Optimistic

Original volume projections:
40,000 units/month by end of 2002.

“I would stake my reputation, my money and my time on the fact that 10 years from now, this will be the way many people in many places get around. If all we end up with are a few billion-dollar niche markets, that would be a disappointment. It’s not like our goal was just to put the golf-cart industry out of business.”

– Dean Kamen



Rogers' Factors	Segway Personal Transporter	EZ Pass Auto Toll System	Web Browser	Mobile Phone
Relative Advantage	?	***** no waiting at toll booths	***** free, instant information	***** wireless calling, but initially expensive
Visibility	?	***** obvious to all users	* not very visible	***** visible in public
Trialability	?	** must enroll to try	***** free download	** contract required
Simplicity	?	*** How does payment work? Who installs?	***** click and view	** “send” button? reception, coverage?
Compatibility	?	***** all vehicles	***** all PCs	***** fits in pocket or bag
Predicted Relative Rate	?	fast	very fast	moderate
Years to “Take Off”	?	~3	~2	~9