# Technology Adoption Lifecycle and Hybrid Seed Corn

**David Moeller, CEO CodeGuard**
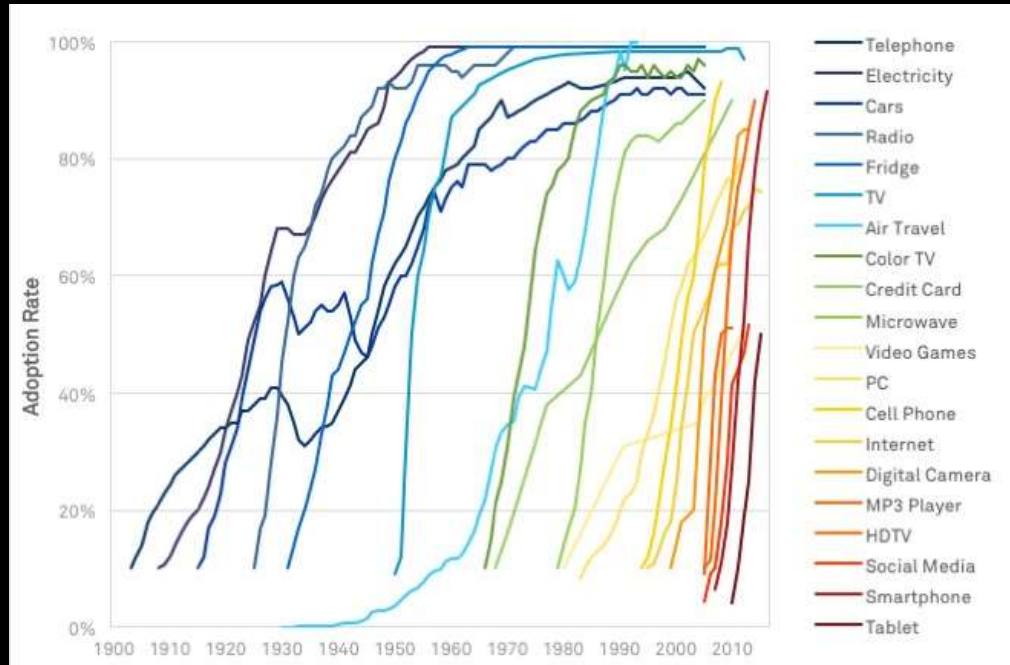
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March 13, 2018

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# Technology Adoption S Curve



Source: Asymco

BLACKROCK®

# 1985

# 2017

# Known for world-class backup

✔ WordPress Backup

✔ Website Backup

✔ Email Archiving

✔ Easy API Integration

✔ World-class Support

✔ White-label Offering

✔ 1-Click Restore

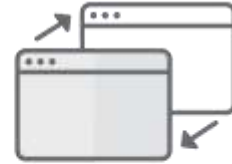✔ Patented Malware Removal

✔ Features for Web Pros

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# But we offer much more

MalwareGone

Automatic WordPress Plugin Updates

Website Migration

Staging Servers

Email Backup

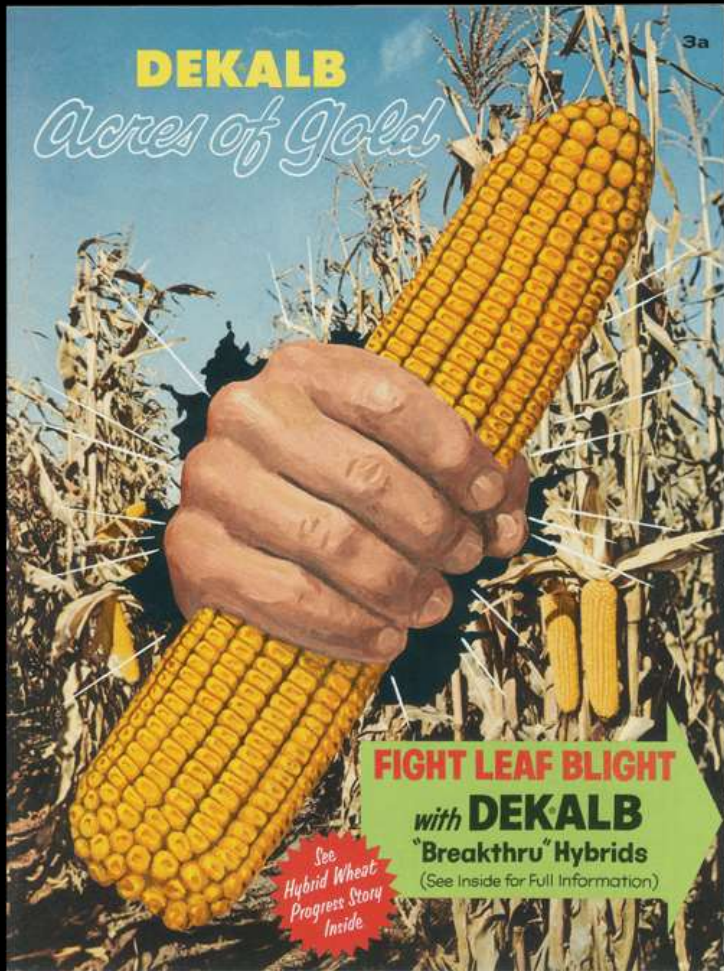Fully Featured API

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web.com®     YAHOO!     bluehost     1&1

CLOUDFLARE®     a small orange     network solutions     Liquid Web™

HostGator.com     WebHostingBuzz     resellerclub

namecheap     ENDURANCE International Group     MOZ     Directi Intelligent People. Uncommon Ideas.

# Overview

Hybrid Seed Corn

Diffusion of Innovations

Bass Model

Modeling the Future

# The Diffusion of Hybrid Seed Corn In Two Iowa Communities*

By Bryce Ryan and Neal C. Gross†

## ABSTRACT

Hybrid seed corn has diffused through the midwest with phenomenal rapidity. In the space of four years, 1936 through 1939, two-thirds of the operators in the two communities studied, changed to the new seed. Relatively few, however, took over hybrid seed for their entire acreage the first year they tried it. This was true even for operators first using the seed at a relatively late date. There appears to be some difference between the diffusion agencies which informed farmers of the new seed and the sources of influence toward adoption. Commercial channels, especially salesmen, were most important as original sources of knowledge, while neighbors were most important as influences leading to acceptance. Although the time pattern of acceptance follows a bell shaped curve, this instance of diffusion cannot be accurately described as following a normal frequency distribution.

## RESUMEN

El maíz de semilla híbrido se ha difundido por el Mediano Oeste con extraordinaria rapidez. En el espacio de 4 años, desde el 1936 hasta el 1939, dos tercios de los agricultores de las dos comunidades estudiadas adoptaron la nueva semilla. Sin embargo, relativamente muy poco de ellos la cultivaron de lleno en el primero año que la consideron. Esto fué cierto también con aquellos que la han usado aún más recientemente. Parece que existe alguna diferencia entre las agencias de difusión que informaron a los agricultores sobre la nueva semilla y las fuentes de influjo que los decidieron a su adopción. Las vías comerciales, particularmente los vendedores, fueron las más importantes fuentes de conocimiento, mientras que los vecinos tuvieron más importancia desde el punto de vista de la aceptación de la simiente. Aunque el modelo del tiempo de adopción conforma con el de una campana, este ejemplo de difusión no puede ser descrito como típico de una perfecta distribución normal de frequencias.

The introduction of hybrid seed corn has been the most striking technical advance in midwestern agriculture during the past decade.[1] Although a few experimenters had been acquainted with this new and sturdier seed for many years, only since 1937 has it become a nationally important production factor. It has been estimated that between 1933 and 1939 acreage in hybrid corn increased from 40,000 to 24 million acres (about one-fourth of the nation's corn acreage). In the North Central region the spread was even more rapid. Although hybrid seed was not available until 1928 or 1929, by 1939, 75 per cent of the corn acreage in Iowa was in hybrid.

The very rapidity of its diffusion makes this trait attractive for study. This is true not only because farmers are usually "conservative," but also because its adoption is well within the memory span of current farm operators, and hence amenable to more intensive study than would

[1] See *Technology and the Farm*, U.S.D.A., 1940, Chapter X.

# Salesmen  Neighbors
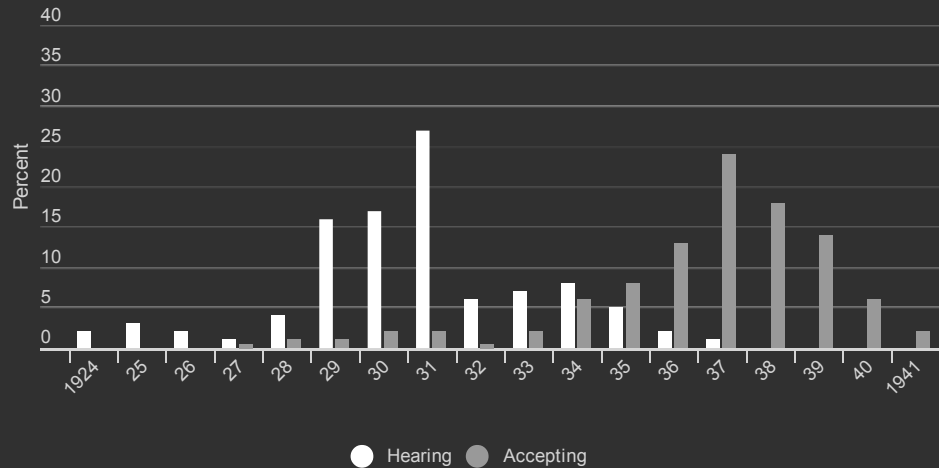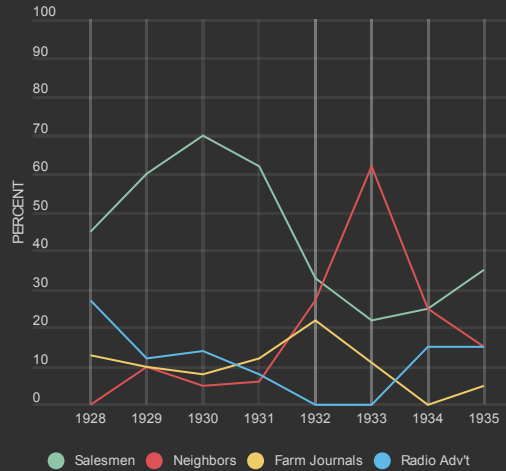
# Farm Journals



# Radio Advertising

# Hear then Accept
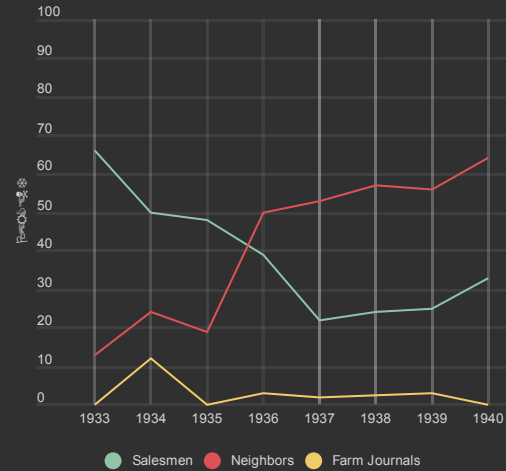


%'s of Farmers First Hearing vs First Accepting Hybrid Seed

# Awareness vs. Action



%of Farm Operators First Hearing of Hybrid Seed Corn Through Various Channels, by Year First Heard

Salesmen  Neighbors  Farm Journals  Radio Adv't

# Awareness vs. Action

## Original Sources of Knowledge and Most Influential

| Source | Original Knowledge | Most Influential |
|---|---|---|
| Salesmen | 49.0 | 32.0 |
| Neighbors | 14.6 | 45.5 |
| Farm Journals | 10.7 | 2.3 |
| Radio Advertising | 10.3 | 0 |
| County Agents, Bulletins | 2.8 | 2.4 |
| Relatives | 3.5 | 4.2 |
| Personal Experimentation | 0 | 6.6 |
| All others | 9.1 | 7.0 |

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# Use it a little, then a lot

Median % of Corn Acreage in Hybrid for Individual Years by Year in Which Operator First Used Hybrid Seed

| Year first used hybrid | 1933 | 1934 | 1935 | 1936 | 1937 | 1938 | 1939 | 1940 | 1941 |
|---|---|---|---|---|---|---|---|---|---|
| Before 1934 | 38 | 50 | 67 | 100 | 100 | 100 | 100 | 100 | 100 |
| 1934 | | 20 | 29 | 42 | 67 | 95 | 100 | 100 | 100 |
| 1935 | | | 18 | 44 | 75 | 100 | 100 | 100 | 100 |
| 1936 | | | | 20 | 41 | 63 | 100 | 100 | 100 |
| 1937 | | | | | 19 | 55 | 100 | 100 | 100 |
| 1938 | | | | | | 25 | 79 | 100 | 100 |
| 1939 | | | | | | | 30 | 92 | 100 |
| 1940 | | | | | | | | 70 | 100 |
| 1941 | | | | | | | | | 54 |

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# Everett Rogers & Diffusion of Innovations
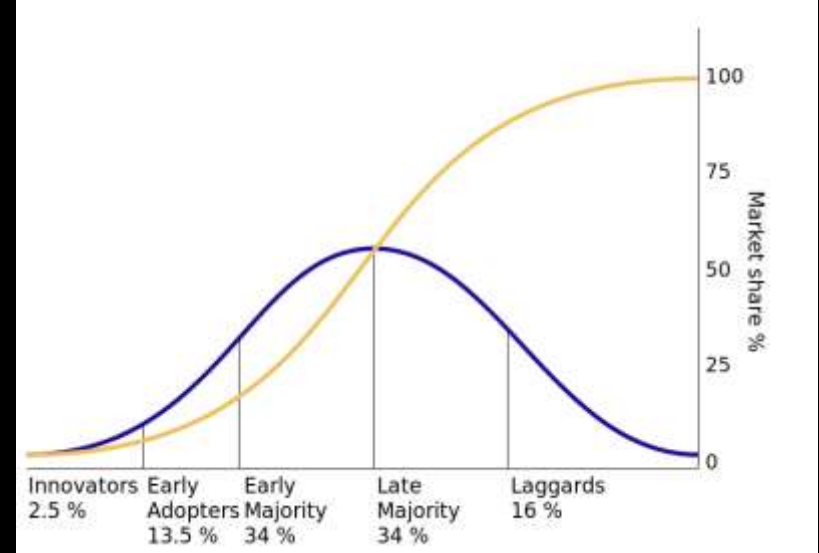
# Frank Bass & Bass Model



New adopters



## Model formulation [edit]

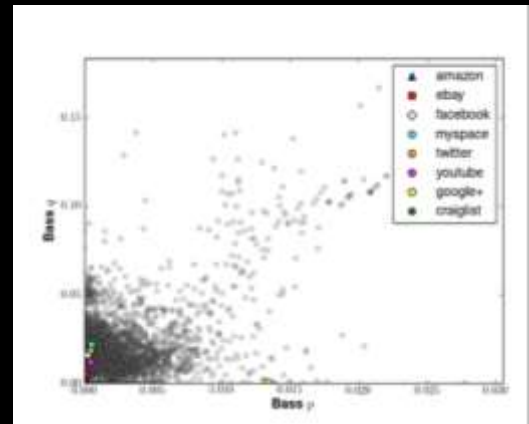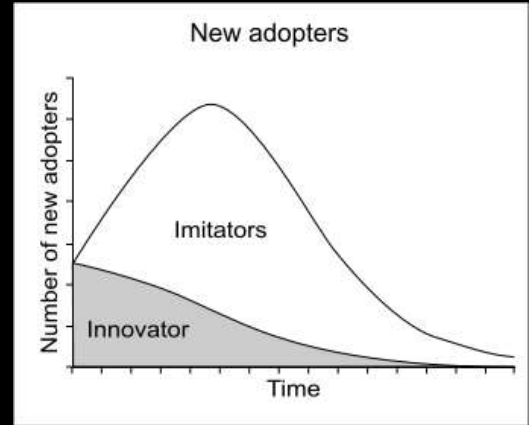$$\frac{f(t)}{1 - F(t)} = p + qF(t) \quad [2]$$

Where:

- $f(t)$ is the change of the installed base fraction
- $F(t)$ is the installed base fraction
- $p$ is the coefficient of innovation
- $q$ is the coefficient of imitation

Sales $S(t)$ is the rate of change of installed base (i.e. adoption) $f(t)$ multiplied by the ultimate market potential $m$:

$$S(t) = mf(t)$$

$$S(t) = m\frac{(p + q)^2}{p} \frac{e^{-(p+q)t}}{(1 + \frac{q}{p}e^{-(p+q)t})^2} \quad [2]$$

The time of peak sales $t^*$

$$t^* = \frac{\ln q - \ln p}{p + q} \quad [2]$$
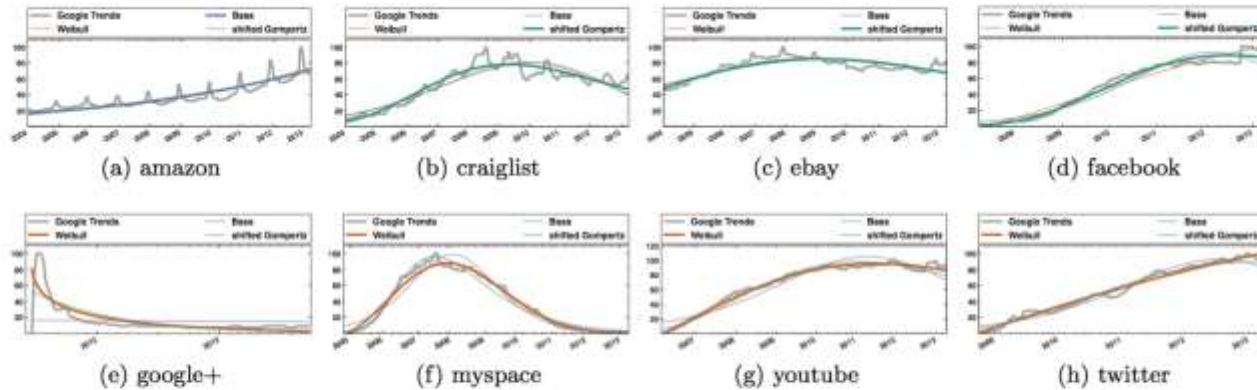
# Explain the Past



Figure 3: Exemplary visualizations of how the three diffusion models (Bass, shifted Gompertz, and Weibull) fit general trends in temporal signatures of worldwide query logs related to several popular and well known social media services and Web-based businesses; the respective best fitting model is emphasized.
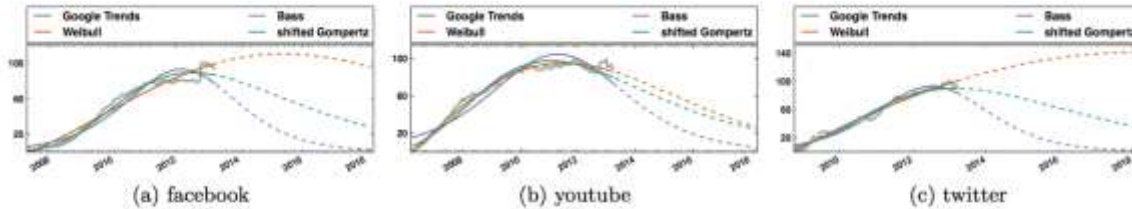
# Predict the Future!



Figure 9: Predictions of future collective interest in exemplary social media services. Gray curves show data obtained from Google Trends; solid colored curves indicate fits to these data, and dashed colored curves show corresponding 5 year predictions. Note that these predictions do not indicate absolute user interest but predict the evolution of relative search frequencies w.r.t. the maximum interest so far which is scaled to 100.
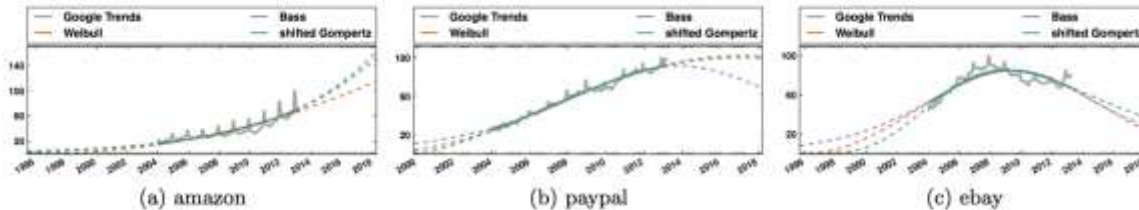


Figure 10: Predictions of past and future collective interest in Web-based businesses launched prior to 2004.

Strong Regularities in Growth and Decline of Popularity of Social Media Services Christian Bauckhage University of Bonn, Fraunhofer IAIS Bonn, Germany Kristian Kersting TU Dortmund University, Fraunhofer IAIS Dortmund, Germany

# The End

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