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Emergence of
Industries and Firms:
Experimentation for
Selection and Adaptation

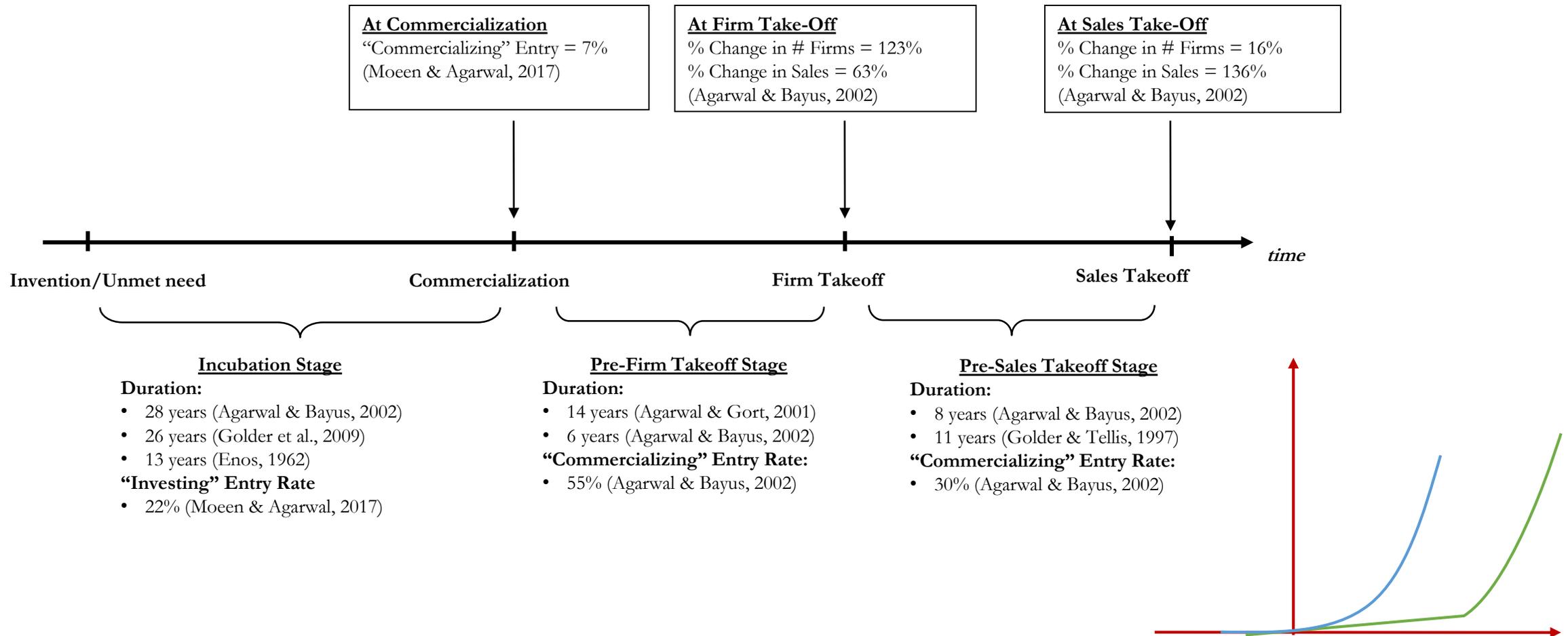
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Industry Emergence (Moeen, Agarwal and Shah, 2018)



Experimentation as adaptation

“A society in which uncertainty is absent is characterized by adjustments as a result of a long process of experimentation” (Knight, 1921, p. 267).

Experimentation as selection

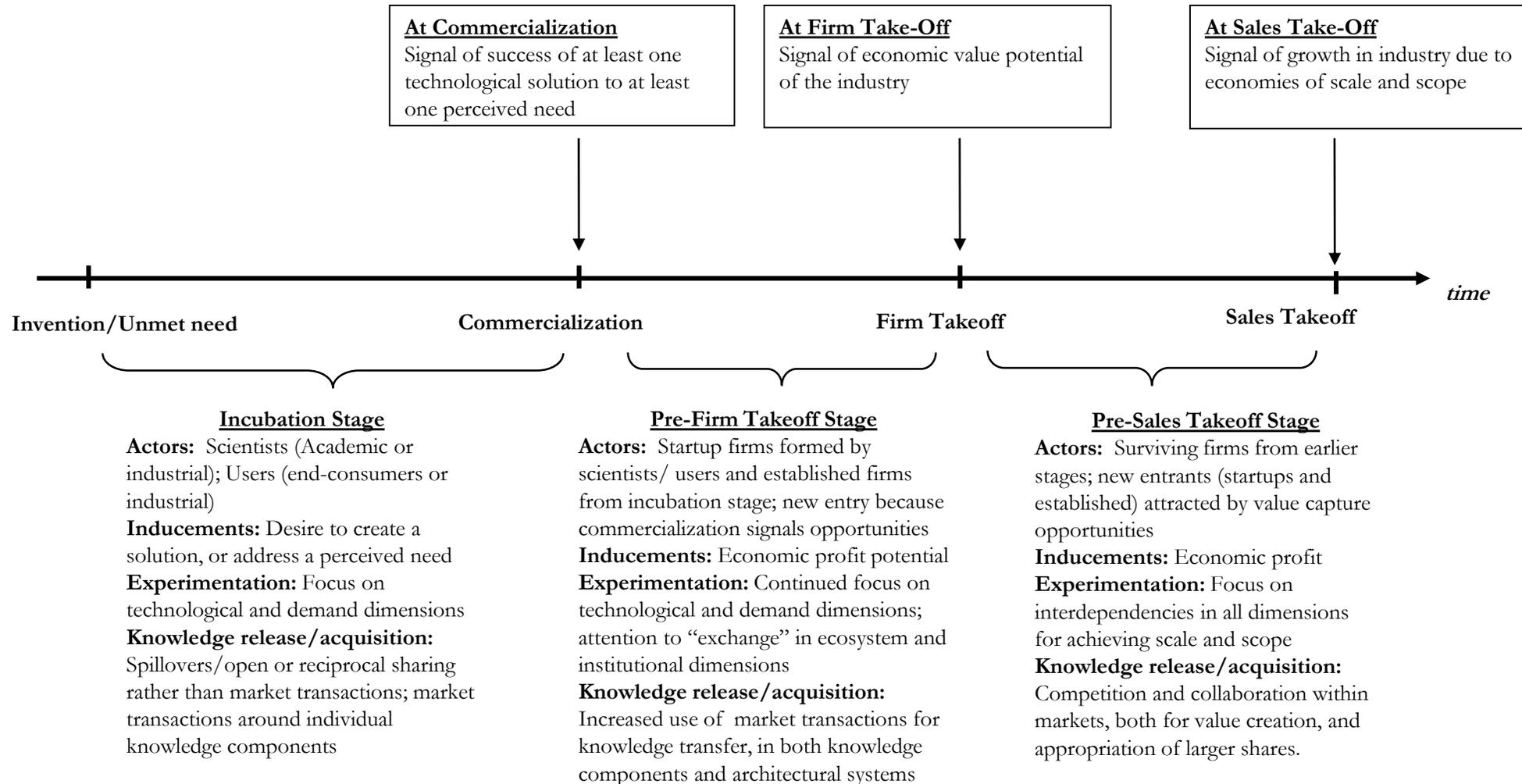
*Bad bets are, of course, common, indeed so common that it is tempting to conclude that the manner in which competing firms pursue innovation is a very wasteful process. Such a characterization would be appropriate were it not for a single point: uncertainty. In fact, **a considerable virtue of the marketplace is that, in the face of huge ex ante uncertainties concerning the uses of new technological capabilities, it encourages exploration along a wide variety of alternative paths.** This is especially desirable in the early stages, when uncertainties are particularly high and when individuals with differences of opinion (often based upon differences in access to information) need to be encouraged to pursue their own hunches or intuitions. Indeed, it is important that this point be stated more affirmatively: **The achievement of technological progress, in the face of numerous uncertainties, requires such ex ante differences of opinion.***

(Rosenberg, 1997, p. 109)

Dimensions of Uncertainty

Uncertainty Type	Definition	Implications for Industry Emergence	Examples	Orienting Literature
Technological Uncertainty	Partial knowledge about technological designs	Impedes product and process innovation and technical refinements	<ul style="list-style-type: none"> – Immunotherapy: whether effective cancer treatments can be technically achieved. – Quantum technology: whether quantum supremacy is achieved. 	<ul style="list-style-type: none"> – Industry and technology evolution: Abernathy, Utterbeck, Tushman, Rosenberg, Suarez
Demand Uncertainty	Partial knowledge about customer functional and price preferences	Impedes fulfilling customer needs and creating value	<ul style="list-style-type: none"> – Drones: how and where commercial drones will be applied – Avatars and surrogates: demand beyond military and medical training 	<ul style="list-style-type: none"> – Marketing: Rogers, Golder, Tellis, Bayus – Technology management: Clark, Adner – Users: von Hippel
Ecosystem Uncertainty	Partial knowledge about configuration of activities that collectively deliver value to customers	Impedes the creation of products and their delivery, in conjunction with complementary products to customers	<ul style="list-style-type: none"> – Solar panels: the importance of financing – Mass production of Electric cars and Tesla – Immunotherapy, and non-stem cell therapy: one-person clinical trials, whether to manufacture in doctor's office or factory, complements such as cell banks or super-donor cell lines 	<ul style="list-style-type: none"> – Complementary assets: Teece, Mitchell, Tripsas – Vertical scope: Williamson, Argyres, Helfat, Qian – Ecosystems: Adner, Kapoor, Afuah
Institutional Uncertainty	Partial knowledge about the formal and social institutions that structure exchange of an industry's products	Impedes exchange and increases transaction costs between customers and sellers	<ul style="list-style-type: none"> – Driverless cars: how regulatory bodies and social norms handle driverless cars. – Ride sharing – Crypto-currencies 	<ul style="list-style-type: none"> – Institutional economics: North, Libecap, Nelson, Wallis – Social legitimacy: Sine, Glynn, Rao, Aldrich

Industry milestones as a consequence of experimentation and subsequent knowledge release/acquisition (Moeen, Agarwal and Shah, 2018)



Emergence of Firms (Agarwal and Shah, 2014)

- Knowledge context of founders affects
 - Type of ideas they bring with them
 - Access to complementary assets
 - Appropriability conditions
- Two interpretations of “Experiments”
 - Entry as a startup itself (a lifecycle view of individual careers)
 - Adaptation post-entry

Google

Scientists



Users



Employees

From the above perspectives of industry and firm emergence, experimentation is...

- critical to uncertainty resolution, and thus growth of firms and industries
- But, much broader a concept than adaptation at firm level.
 - Failure of startups is itself an outcome of an experiment
- ≠ Lean startup methodology
 - Experimentation is not necessarily driven by (short term) economic potential
 - Assumptions of lean startup methodology may not always apply
 - Uncertainty in incubation and pre-sales take off periods may render “customer discovery” process ineffective
 - Entrepreneurship by users and employees represent prior knowledge of potential use , and operations, and need not conform to conditions for lean startups