

Bubbles and Crashes: Technology Coding Guidelines

Coders used this coding structure for each of the technologies in question. End codes used in the final analysis are shared in the accompanying data files.

5 Pager Rating Guidelines

Intellectual Property Regime

- **Did isolating mechanisms (patent protections) exist for first-mover?**

1. No isolating mechanisms – patents or licenses – existed.
3. First mover did not have control of intellectual property, marketing and sales, or manufacturing.
5. First mover had some control of intellectual property, marketing and sales, and/or manufacturing.
7. First mover had complete control of intellectual property, marketing and sales, and manufacturing but only some control in one or two of those aspects.
9. First mover had control of intellectual property, marketing and sales, and manufacturing.

- **Control**

1. Had no control.
2. Had some control.
3. Had complete control

- **If isolating mechanisms exist, were they actually enforced?**

1. No sign of isolating mechanisms being enforced.
2. Movers attempted to enforce isolating mechanisms but failed due to ambiguity or expiration.
3. Disagreements on who should control the isolating mechanisms resulted in non-enforcement.
4. Multiple valid movers in different countries made enforcing isolating mechanisms difficult.
5. Multiple movers existed with isolating mechanisms and at least one of them made valid attempts to enforce them.
6. Isolating mechanisms were enforced but other parties could easily research ways around them.
7. Isolating mechanisms were enforced but other parties quickly developed and patented (or isolated) innovations on the technology.
8. Multiple movers enforced isolating mechanisms with agreements on how to enforce them. No other attempts were made to build a similar product.
9. Isolating mechanisms were completely enforced. Anyone who wished to use the technology had to obtain patent rights or licenses to do so.

· **If isolating mechanisms did exist, can other players work around these protections to create their own slightly different version of the technology (e.g. pharmaceuticals, chemicals)?**

1. Only the original mover or licensed companies could produce the product and no similar versions were made. (ex. Freon)
3. Similar versions were made after patents expired or under special circumstance. Other versions were not identical. (ex. Magnetic Tape Recorder, Bakelite)
5. Isolating mechanisms existed but other methods were available (ex. Xerox) or improvements on the technology made a slightly different product (ex. Continuous Hot Strip Rolling)
7. Despite isolating mechanisms existing, a small number of companies made a similar product (ex. Wankel Motor, Jet Engine).
9. In the case of drugs, a large number of producers sought to find ways of synthesizing the product or made similar products with little variation (ex. Sulfa).

· **Can the ultimate success of the leaders in the industry be attributed to these isolating mechanisms?**

1. Leaders in the industry did not gain profit and were not successful (ex. Hovercraft).
3. Leaders in the industry were successful due to many innovations including the highlighted technology (ex. Bakelite) or not successful in a monetary sense (ex. Penicillin).
5. Leaders in the industry received some but not a considerable amount of profit from the technology (ex. Streptomycin).
7. Disagreements in who held isolating mechanisms hindered success or split it between parties (ex. Fluorescent lamp)
9. The success of the leaders can be attributed to their isolating mechanisms (ex. Continuous Hot Strip Rolling)

Value Chain

· **Did the technology disrupt the value chain and industry structure or did it create a new type of value chain entirely? If the technology did disrupt the value chain, who did it? And which part of the value chain was disrupted?**

1. The technology did not disrupt the value chain or create a new one (ex. Wankel Motor).
3. The value chain was not greatly affected overall; an improvement was made on the technology or method that caused an industry shift (ex. Transistor)
5. The value chain became more established or shifted slightly after the introduction of the technology (ex. Color Photography, Bakelite)
7. The technology either created a new value chain or dramatically disrupted it with the addition of another technology.

9. Technology created a new type of value chain entirely (ex. Xerography)

• **Does the technology make other technologies obsolete? Why?**

1. The technology does not make other technologies obsolete (ex. Magnetic Tape Recorder)

3. The technology was used in certain applications where it was found more efficient but previous technologies still used in others (ex. Jet Engine)

5. The technology made a specific part of a technology obsolete (ex. Power Steering)

7. The technology was viewed as more valuable than a previous technology (ex. Color Photography) or made another method obsolete over a period of time (ex. Continuous Hot Strip Rolling).

9. Technology completely replaced another immediately after development or does something that could not be done before (ex. Xerography)

• **Who is the end-user of the technology, i.e. is the technology B2B or B2C? Is the technology consumer- or public-facing?**

1. Technology is B2C and consumer facing (ex. DDT).

3. Technology was mostly made for consumers but has potential to be used within industry (ex. Color Photography).

5. Technology is both B2B and B2C (ex. Magnetic Tape Recorder).

7. Technology mostly B2B but made available to consumers later (ex. Fluorescent Lamp)

9. Technology is B2B. (ex. Modern Steelmaking)

Investment Target

• **Is the target for investment a public or private firm?**

1. Public

3.

5. Mix

7.

9. Private

• **Is such an investment a pure or indirect play on technology? Did the companies have a diversified portfolio of technologies (indirect) or did they only do this (direct)? Could someone on the sidelines invest in these companies? How?**

1. Pure play on technology, companies only did this.

3. Company was a direct play on technology,, may have introduced other technologies later on (ex. Helicopter).

5. Company originally diversified but eventually focused on production of the new technology (ex. Xerography).

7. Technology itself was direct but used to build a diversified technology (ex. Basic Oxygen Process).

9. Companies had a diversified portfolio of technologies (ex. Jet Engine, Power Steering).

Coordinating Event

- **Is there a collectively-experienced introduction of the technology, i.e. Was there some event that happened that focused the public's attention on this technology? Was there a public demonstration of value?**

1. There was no event that sparked public interest (ex. Modern Steelmaking).
3. Technology showed value either years after invention or slowly over time (ex. Power Steering).
5. Technology was introduced and sparked the attention of a select portion of the public (ex. Helicopter).
7. Technology sparked public attention for those affected (ex. Penicillin) or gained attention after improvements were made (ex. Xerography).
9. A clear coordinating event occurred, a large portion of the public's lives was greatly affected by its invention (ex. Incandescent Lamp).

- **Is the coordinating event a single event or a series of demonstrations over time of the technology's value?**

1. The coordinating event was a series of demonstrations over time (ex. Basic Oxygen Process).
3. Technology introduced through series of demonstrations that involved improvements in the technology (ex. Helicopter) or through mostly private encounters (ex. Bakelite).
5. Introduced to the public in a single event but did not gain popularity until later on (ex. Xerography).
7. Coordinating event single event with milder events occurring after to enhance public attention (ex. Sulfa Drugs).
9. The coordinating event was a single event (ex. Hovercraft).

- **Does the technology have crossover appeal? Is there evidence that excitement about the technology was not solely limited to industry press, i.e. did the popular press also cover this technology?**

1. Excitement about the technology was solely limited to industry press (ex. Continuous Hot Strip Rolling).
3. Popular press did mention introduction of the technology but excitement was limited to industry press (ex. Basic Oxygen Process).
5. Popular press covered the technology but did not have a lot of cross over appeal outside of certain circles (ex. Power Steering).

7. Popular press covered the technology with both positive and negative representations (ex. DDT).
9. Popular press covered the technology and there was clear excitement in the public (ex. Color Photography).

· **Did the technology create a paradigm shift in fundamental assumptions of how things should be done?**

1. The technology did not create a paradigm shift in assumptions of how things should be done (ex. Fluorescent Lamps).
3. An initial shift in assumptions of how things should be done occurred but could not be followed through due to timing or other inadequate technologies (ex. Wankel Motor).
5. Paradigm shift in assumptions for the individual's affected by the discovery of the technology (ex. Streptomycin).
7. Paradigm shift in assumptions occurred due to technology practicality (ex. Modern Steelmaking) or other factors, i.e. not attributed to technology's discovery (ex. Freon).
9. A large paradigm shift in assumptions occurred (ex. Penicillin).

· **Does the technology have a "wow" factor?**

1. The technology has no "wow" factor (ex. Fluorescent Lamp).
3. Technology has a "wow" factor for the industry but not for speculators (ex. Transistor, Modern Steelmaking).
5. Technology has a "wow" factor for the industry and is impressive to select groups in the public (ex. Wankel Motor).
7. Technology has a "wow" factor reaching far beyond industry, made inconceivable things possible (ex. Color Photography, Jet Engine).
9. Technology has a global "wow" factor, saved lives, eradicated disease (ex. DDT, Sulfa Drugs)

· **Is it simply a case of "you know it when you see it," e.g. Justice Potter Stewart's comments re pornography?**

1. Obvious use of technology not clearly known or understood.
3. Due to timing or problems in design, technology use not obvious in beginning (ex. Fluorescent Lamp).
5. Technology was met with skeptics initially but popularity picked up quickly (ex. Xerography).
7. Technology uses and applications apparent after discovery (ex. Modern Steelmaking).
9. Technology only had one use that was obvious (ex. Streptomycin).

False Uncertainty

• **Is the business model to monetize this technology abundantly clear, obvious? Is it assumed that the business model is understood?**

1. Business model not obvious or clearly understood.
3. Technology has many uses or made larger production possibilities that made is business model hard to predict (ex. Helicopter, Modern Steelmaking).
5. Technology business model clear but many parties were involved so unclear who would make profit (ex. Streptomycin).
7. Technology used in a variety of products with well-established business models (ex. Transistor).
9. Technology followed business model of previous similar technologies (ex. Bakelite).

• **Is there evidence in the public markets of overconfidence?**

1. No evidence of public overconfidence (ex. Continuous Hot Strip Rolling).
3. Overconfidence present in the private market but technology ended up having a lot of problems (ex. Modern Steelmaking, Transistor).
5. Evidence of public market overconfidence but special circumstances brought down overconfidence quickly (ex. Jet Engine).
7. Public overconfidence existed but technology proved to be as useful as predicted (ex. Bakelite).
9. A large amount of public overconfidence present that eventually ended with technology not living up to expectations (ex. DDT).

• **Is there public discourse of “how this technology will do X as [previous technology] did Y”? Is there evidence in the historical record of how people thought this technology would revolutionize an industry in a way another technology revolutionized another, i.e. are there analogies/heuristics used to process/describe the new technology? What is the common wisdom with regard to this technology? Please describe very specific examples.**

1. There was no analogy used to describe the technology (ex. Penicillin).
3. The technology followed similar technologies but it's effects could not be compared (ex. Bakelite).
5. The technology can be compared to others in the same industry but had unique characteristics (ex. Helicopter).
7. The technology can be compared to a previous technology with faster or more efficient production capabilities (ex. Jet Engine).
9. Technology has a clear analogy (ex. Fluorescent Lamp).