

Assignment: Emerging Technology Analysis (Written)

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Course: *MGT 340*

Title: *Management of Emerging Technologies* (3 units)

“Any sufficiently advanced technology is indistinguishable from magic.”

-Arthur C. Clarke (1917-2008)

“The best way to predict the future is to create it.”

-Peter Drucker (1909-2005)

Goal

The purposes of this assignment are as follows:

- To analyze a technology, an industry, and a firm with breadth and depth
- To identify one or more important strategic issues facing the firm
- To draw out ethical issues of importance with respect technology, industries, and firms
- To use skills, knowledge, abilities from this course and prior courses
- To make actionable recommendations to overcome obstacles and leverage opportunities
- To continuously improve the practice of writing in substantive business contexts

Instructions

In general, your team’s task is to analyze a technology, an industry, and a firm that might develop such a technology within an industry. Essentially, your team is analyzing a key technology and related issues.

Both team composition and selection of a firm will be done before the middle of the semester. Each person in each team must contribute both to the analysis and to the writing. The written deliverable must be printed and delivered to the instructor at the beginning of class on the due date. The written deliverable must also be submitted electronically via email to the instructor no later than 1 hour before the beginning of class on that day.

Deliverable

The due date is listed on the course outline. Before that due date, there should be enough time in or out of class to go over any questions your team may have.

Length

The “Main Body” of the written deliverable must be no less than ten pages and no more than fifteen pages (not including the cover page, cover letter, executive summary, references, or

appendices). The written deliverable may include an Appendix or may not include an Appendix depending on circumstances.

Scoring

There will be 100 points allocated for breadth and depth of content. There will be 100 points allocated for language use and grammar.

Evidence and Persuasion

Leadership is likely the most important aspect of human capital in a firm. Strategy is the most important set of tasks in a firm. However, strategy within a firm depends on understanding the industry (or industries) a firm competes in. And further, industry analysis depends on understanding one or more aspects of societal context. Your team's report starts with "macro-" strategic issues, and winds its way down to "micro-" strategic issues.

Despite the terms "data-driven" and "analytics-focused" being popular, strategy is actually a mix of quantitative and qualitative evidence. Individuals use evidence to help inform decision-makers, but evidence *by itself* does not make any strategy. Individuals make strategy. Not only do individuals make strategy ("strategy formulation"), but individuals evaluate the results of data analysis of the strategy ("strategic execution").

Since individuals are central to strategy, then both objectivity and subjectivity are important. By objectivity, I mean the rigorous and relevant use of evidence. By subjectivity, I mean persuasion. Data, even financial data, isn't enough, at least not for strategic issues. Professionals and managers need to *convince* executives, especially on issues of strategic importance. Your team earns your way to the strategy table by being able to persuade a decision-maker that your team's view is the best one. Another way to look at it is as follows: You, yourself, are likely to be a decision-maker with substantive organizational responsibilities, and in that elevated capacity you would want the best evidence and logical argumentation *provided to you*.

Finally, remember what strategy is about: Strategy is long-term in nature, organization-wide in scope, and requires substantive change in working capital and/or human behavior. Your team's analysis should, as much as reasonably possible, touch upon each of those four elements as appropriate. The amount of *emphasis* given to one over the others is, naturally, contextually dependent.

Content

In general, the structure of the content ("main body") of the written deliverable is to follow the general outline and sequence of the scoring rubric. Use your own words, and not chapter titles. Apply the concepts from chapters that help your team analyze the firm, industry, and society. In addition, of course, to material from this course, this assignment builds upon ideas from several general education, lower-division core, and upper division courses.

The following document contains additional details regarding this written analysis including the correct sequence:

<https://ocw.smithw.org/mgt340/casewritingrequirements.pdf>

Use a “References” (or “Works Cited”) page. Make sure your team also uses “In-Text” Citations as well. The specifics of the citations are enumerated in the document above.

Introduction

Provide an introduction and overview of each member of the team. What skills, knowledge, and abilities does each team member bring to the team? How do those skills, knowledge, and ability help others understand technologies, industries, and firms? Which skills, knowledge, or abilities are from education and which are from experience?

Only one of the three technology/industry choice could be made. What were some of the salient (material) aspects of the other two choices? Even though you didn’t study them in detail, what is interesting and important about each of them?

Technology-level Analysis

Technology issues tend to revolve mostly around some aspect product or process with a scientific or engineering basis. How do you know this is an emerging technology rather than a current technology? Sometimes, one technology is intertwined with one or more other technologies. If so, your team might have to pick a single technology to analyze.

Industry issues touch upon societal issues too which can also have overall changes or trends. Often, these are Legal or Environmental concerns. The FRED database can useful for macro-level issues. Also, the General Social Survey database can be useful.

Naturally, industry issues touch upon firm issues. You can discuss one or more firms as examples within an industry, but keep the analysis at the industry-level. That is, an existing or new firm within an industry could produce this technology.

Use of Two Non-Class Articles

Your team must use at least two external articles to support your analysis. See “Sources for Non-Class Articles” (below). These articles help set up the technology background and issues, or in the terms of our class, the specific technology *opportunities* and *challenges* that the industry faces.

Use of Two Textbook Theories

Your team must use at least two different Textbook theories, models, or frameworks in your team’s analysis. One of the theories must come from Chapters 1, 2, 3, 4, or 5. The other theory

must come from one of the other Textbook chapters. Your team's task is to choose the theories that *best* support your team's reasoning and your team's analysis in addressing the details of the various opportunities and challenges regarding the technology.

Analogy Drawn from a Class Library article

Your team must draw at least one analogy from one of the "Library" readings from our course outline. Analogies help strengthen your team's analysis. It's easy to make a weak analogy; it requires significant effort, substantive review, and productive discourse with the entire team to make a strong analogy.

Mergent Online and IBISWorld, among other sources, can be helpful for quantitative and qualitative data at the industry-level.

Engineering Principles

Every technology has one or more dependencies or "stacks". What is (are) the dependency(ies)/stacks of your technology choice? Draw it and describe it. You can stop at the level energy or power. If your technology is energy or power, then describe the source of the energy or power as the dependency. Engineering is also about working prototypes and minimal viable product. Sometimes, a working prototype is all that has been made. The Engineering Lifecycle is "Design" → "Build" → "Utilize" → "Dispose". Finally, Engineering is about safety, security, reliability, interoperability, maintainability, durability, scalability, performance, and related topics. Explain your answer.

Scientific Fundamentals

Every technology is a product of *basic science* (research) and *applied science* (practice). What kind of science do you (and we, and investors) need to learn more about to more fully understand your technology choice? You must choose at least one of the following sciences: **Physical** (e.g., physics or chemistry), **Earth and Environmental** (e.g., climate sciences or hydrology), **Biological** (e.g., genetics or neuroscience), **Health** (e.g., diseases or neurology), **Computing** (e.g., computer science, artificial Intelligence, or data science), or **Psychological** (e.g., cognitive psychology or social psychology). See:

<https://www.nature.com/nature/browse-subjects>,

<https://ccecc.acm.org/guidance>,

and/or

<https://www.apa.org/education-career/guide/subfields>

Explain your answer.

Industry-level Analysis

Industry issues tend to be mostly unique to a particular industry. Often, these are Political, Economic, Sociological, Technology concerns. Where are the power centers located? What the power dynamics in the industry (or industries)? How are they changing? How are the players, or peers of the firm, changing or defending their relative positions? Sometimes, firms compete in multiple industries. If so, your team might have to pick a single industry to analyze.

Industry issues touch upon societal issues too which can also have overall changes or trends. Often, these are Legal or Environmental concerns. The FRED database can be useful for macro-level issues. Also, the General Social Survey database can be useful.

Naturally, industry issues touch upon firm issues. Don't mix the two in the industry analysis, but the nexus (intersection) between one or more industry issues and one or more firm issues can make a nice transition in the written or presentation.

Use of Two Non-Class Articles

Your team must use at least two external articles to support your analysis. See "Sources for Non-Class Articles" (below). These articles help set up the technology background and issues, or in the terms of our class, the specific technology *opportunities* and *challenges* that the industry faces.

Use of Two Textbook Theories

Your team must use at least two different Textbook theories, models, or frameworks in your team's analysis. One of the theories must come from Chapters 6, 7, 8, or 9. The other theory must come from one of the other Textbook chapters. Your team's task is to choose the theories that *best* support your team's reasoning and your team's analysis in addressing the details of the various opportunities and challenges in the industry.

Use of a Non-Textbook Theory

Your team must use at least one theory from the class lectures *not* from the Textbook. These would be specific elements drawn from readings on [Economic Drivers](#), [Leadership Overview](#), [Technology and Analytics](#), and [Complex Systems](#).

Analogy Drawn from a Class Library article

Your team must draw at least one analogy from one of the "Library" readings from our course outline. Analogies help strengthen your team's analysis. It's easy to make a weak analogy; it requires significant effort, substantive review, and productive discourse with the entire team to make a strong analogy.

Opportunities/Challenges Trade-offs

Firm issues tend to be broadly categorized by “level”. Recall the two “levels” from the Emerging Technology ‘Story’ assignment done earlier in class: the *product*-level (“key goods or services”) or the *functional*-level (“crucial internal processes”). Strategy involves at least one but possibly more of those two levels. Depending on the technology, industry, and firm strategic issues, teams will need to choose the right mix of those three. Minimally, a team will need to balance breadth vs. depth, quantitative vs. qualitative techniques, strategic formulation vs. strategic execution, and theory vs. practice. Different strategic issues require a different set of balances. Also, even if two MGT 340 teams chose the same company, the resulting analysis may be similar but not exactly the same. This is due to 1), the nature and complexity of strategic analyses, and 2), differing experiences, expectations, and perspectives of individuals and teams.

Decision Table

Your team must use quantitative (numeric data) reasoning in your team’s analysis at the industry-level. Your team needs to make a decision table similar to the ones presented in the Course Outline online. The table can be one of two types: 1), comparing a technology across two different industries (or sub-industry), or 2), comparing an industry across two different technologies (or one component of a larger technology). An example of the former is electric power for either passenger vehicles or long-haul trucks. An example of the latter is a causal food chain choosing between traditional hamburger meat and synthetic meat. Also, if analyzing a technology use at least two industries in your team’s table; similarly, if analyzing an industry use at least two different technologies. Finally, where your team has data, use data to inform the table’s attributes, weights, and values. Where your team doesn’t have data, your team can estimate or speculate as needed. When estimating or speculating any number, just be clear to the reader and audience what your team is doing. See, for example:

<https://ocw.smithw.org/mgt340/decision-table-technology-by-industry.xlsx>

<https://ocw.smithw.org/mgt340/decision-table-industry-by-technology.xlsx>

Mergent Online and IBISWorld, among other sources, can be helpful for quantitative and qualitative data at the industry-level.

Ethical-level Analysis

Socio-technological theory informs us that technology is, ultimately, not distinct from individuals. As such, ethical dimensions not just matter but matter greatly.

Use of a non-Class Articles

Your team must use at least one external article to support your team’s analysis. See “Sources for Non-Class Articles” (below). These articles help set up the technology background and issues, or in the terms of our class, the specific ethical *opportunities* and *challenges* that the firm faces.

Analogy Drawn from a Class Library article

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U.N. Sustainable Development Goals

Ethical issues can be broad and expansive but to analyze them, much less make actionable recommendations, the need to be clear and explicit. Which category does your emerging technology fall into? Be specific.

<https://www.unescap.org/2030-agenda/sustainable-development-goals>

CSR Justification

Your team must use at least one theory from our brief class discussion on Corporate Social Responsibility (CSR). Approaching an ethical issue requires a CSR justification. In other words, CSR grounds the ethical issue. A CSR theory or theories makes the time, resources, and effort directed at evaluating the issue leading change forthright and valuable. Which CSR element does your team feel most applies?

<https://ocw.smithw.org/mgt360/montana-charnov-csr.pdf>

Additionally, make any reasonable counter-argument that your team feels is appropriate. You do this by using a different CSR *theory*. Again, draw upon the theories in our class CSR reading (above).

Normative Ethics

CSR theory, in turn, is based up Normative Ethics. Normative means “should”. Your team must use at least one ethical theory (Utilitarianism, Deontology, Nicomachean, Rights, or Justice, but not CSR because that was in the prior section) from the “Ethical Decision-making” presentation in the “Assumptions I’ll Make About You” section of the first day’s class.

<https://ocw.smithw.org/mgt360/ethical-thinking-ws-short.pptx>

Additionally, make any reasonable counter-argument that your team feels is appropriate. You do this by using a different ethical *theory*. Again, draw upon the theories in our class “Ethical Decision-Making” reading (above).

Conclusions

Provide actionable recommendations to the top management team (“C”-level executives). There should be more than a single recommendation, and there should be some richness to the

recommendations. The former breadth is needed because this analytical report is about strategy, not operations, and therefore it is about change, relationships, and interactions. The latter depth is needed because this analytical report must provide a foundation for further decisions by the top management team. Also, be clear as to how your strategy recommendations should be evaluated (e.g., Drucker's Principles, Balanced Scorecard etc.).

No analysis is ever fully complete. Describe your team's limitations as appropriate. Might the team have suffered from one or more cognitive biases (a good list is available on Wikipedia). Could you have benefitted from a specialist from a different discipline? Essentially, what might be important but you know you are missing it?

What additional *quantitative* data might be useful for future work? Does it exist and you didn't have time? Do you even know if the data exists at all? What additional *qualitative* data might be useful for future work? Could an in-depth interview, oral history, focus group, ethnography, content analysis, or case study be a helpful method? (each of these have Wikipedia pages).

Sources for Non-Class Articles

The sources for the articles for this class will be drawn from the following set:

- Newspapers (Dailies)
 - Los Angeles Times
 - New York Times
 - The (London) Times
 - Wall Street Journal
 - Financial Times

- Magazines (Weeklies or Monthlies)
 - The Economist
 - Bloomberg BusinessWeek
 - Forbes
 - Fortune
 - Barron's
 - MIT Technology Review
 - Wired
 - Inc.

These sources embody a high degree of investigative journalism regarding business-related activities. To make a strong analogy, you want sources that emphasize authority, educational value, intent, originality, and quality. If you want to use something else, it must be approved by me in advance (it's possible, but have a back-up plan just in case).

Sources for Non-Class Articles (Science and Engineering)

There are no restrictions as to the sources to help with either Scientific Learning or Engineering Stack. All are fine, including Wikipedia.

Sources for Quantitative Reasoning

A good start for data is the Business Databases available via the Library:

<https://libguides.csun.edu/bus/library-databases>

The FRED database is good for macro-level data. It's run by the Federal Reserve Bank in St. Louis:

<https://libguides.csun.edu/az.php?a=f>

Data-Planet is well-organized (hierarchical) system of data that helps with various kinds of business, political, and social queries, with results that can be filtered by year and region.:

<https://libguides.csun.edu/az.php?a=d>

Remember too that for general, broad information, the U.S. Census (data.census.gov) can be quite helpful, especially for demographic data and trends (formerly known as the American Fact Finder):

<https://libguides.csun.edu/az.php?a=d>

Mergent Online also provides extensive information on companies and their competitors. It provides more firm information than what is required by the Securities and Exchange Commission (SEC) and can then therefore do industry-level analyses:

<https://libguides.csun.edu/az.php?a=m>

IBISWorld provides some of the best publicly available data on industries and markets. IBISWorld combines public- and private-data together for industry-by-industry analyses:

<https://library.calstate.edu/northridge/databases/alphabetical?alpha=I>

One CSUN-provided database for company stock prices is Y-Charts. Y-Charts is useful for accessing stock prices, among other things:

<https://library.calstate.edu/northridge/databases/alphabetical?alpha=Y>

Another CSUN-provided database is CalcBench. CalcBench is useful for accessing publicly-held financial statements. The source of this database is the SEC EDGAR system, however the web interface and usability is much improved over the standard EDGAR web interface:

<https://library.calstate.edu/northridge/databases/alphabetical?alpha=C>

The CSUN Library provides links to additional statistical data as well:

<https://library.calstate.edu/northridge/databases/subject/statistical-data>

Other sources of quality data that students have found useful in the past are:

<https://WSJMarkets.com/>

<https://google.com/finance>

<https://yahoo.com/finance>

<https://www.theharrispoll.com>

<https://www.statista.com/>

<https://www.axios.com>

Tips for Quantitative Reasoning

Financial ratios and marketing data are a start but they, by themselves, are incomplete. Look for trends and patterns. What are you comparing and contrasting? Just solely in the area of performance, there are at least five major kinds of performance evaluation:

Improvement

Comparing current performance with past performance.

Comparative

Comparing current performance to the performance of peers.

Goal

Comparing current performance to the performance stated in a clear/explicit goal.

Ideal

Comparing current performance to an ideal or perfect performance.

Stakeholder

Comparing current performance to the expectations of one or more stakeholders.

You'll most likely rely on financial statements but there are other kinds of data too (e.g., marketing, operations, management). Recall the "Balanced Scorecard" (examples on Wikipedia). You must make a conscious decision to exclude one of these. Be prepared to justify your answer.

Just understanding data is difficult. *Data* is raw, *Information* is meaningful data, *Knowledge* combines explicit information with tacit information, and *Wisdom* is extraordinary insight or foresight. In your quantitative reasoning, can you distinguish between these in a clear way; that is, clear in the eyes of the decision-makers (audience)?

Which parts of your analysis are relatively *objective* (fact-based, education-based, primary-sources, first-person)? Which parts are relatively *subjective* (intuition-based, experience-based, secondary-sources, third-party)?

Are you *explaining* or *predicting*? Both are about understanding, however, explanations are of the recent past, and predictions are about the near future. Both are important but require different kinds of analytical techniques (the former, perhaps, hypothesis testing; the latter, perhaps, linear regression).

Are you *modeling* or *judging*? You develop models when you have some data; you use judgment when you don't have much data.

How have you maximized *rationality* and/or minimized *uncertainty* in the eyes of decision-makers? How have you leveraged *serendipity* and/or controlled *complexity*, again, in the eyes of the decision-makers?

Have you discussed *reward* and *risk* in the same context? One without the other will lead to weak results. Have you discussed *measurement* and *management* in the same context? One without the other is ineffective.

Perhaps most importantly, link your qualitative recommendations with your quantitative support. For example, at the strategic-level, you can't just say purchase new factory equipment or change the ad-buys from Google AdSense to Spotify. If that recommendation requires resources—and it will—where will those resources (funds, budget, re-allocation) come from (e.g., working capital, cash flow, discounted ROI on sales over time, stock buy-back, net amortization, etc.)?