Teaching Note

Finding the perfect strategic partner for an FDA approved drug

George Whaley, San Jose State University
Jessica Brown, San Jose State University

Critical Incident Overview

MannKind Corporation is a small biotechnology firm faced with a critical decision to find a partner to market its first product The Food and Drug Administration (FDA) approved the firm's inhalable dry powder insulin (Afrezza) in June 2014 that has the potential to help millions of diabetics worldwide. MannKind burned cash at a high rate to develop Afrezza; hence, it is not yet profitable and other products in their pipeline are years away from FDA approval. Management decided to review a short list of stable pharmaceutical firms to select the best strategic partner. Based on the experience of other firms and their own experiences, management knew money and marketing acumen were not the only items needed to make the partnership successful. The incident (CI) ends with the management mulling over an appropriate decision process and tools to select the best strategic business partner to market Afrezza.

Graduate and advanced undergraduate courses in strategy, decision-making and entrepreneurship are the primary focus. Due to the industry context, graduate management classes in biotechnology, related life science fields, and workshops for professionals in the life science industry should be considered.

Research Methods

All pertinent data in this decision critical incident were gathered from secondary sources. Statements made by company officials and industry observers were built from online searches, company records on the firm's website, government reports and other public sources. Thus, the real location, firm name, employees and clients were used and a company publication release was not required.

Learning Outcomes

After completing this assignment, students should be able to:

1. Identify factors involved in selecting appropriate pharmaceutical business partners to commercialize FDA approved biotechnology products.

2. Apply decision support system models to analyze critical success factors for strategic alliances between biotechnology and pharmaceutical firms.

3. Defend decision-making models that are appropriate for selecting the best pharmaceutical strategic business partner to commercialize FDA approved biotechnology products.

Discussion Questions

1. Which companies are potential strategic business partners to market MannKind's FDA approved product? (LO 1)
2. What practical DSS tools could be used to determine critical success factors and feasible alternatives for selection of MannKind's strategic business partners? (LO 2)
3. What decision-making tools can be used to select the best strategic partner for MannKind? (LO 3)

Answers to Discussion Questions

1. Which companies are potential strategic business partners to market MannKind's FDA approved product? (LO 1)

As pointed out in the Relevant Theory and Literature section, it is critical to the survival for most small biotech firms that they seek and form strategic alliances to commercialize their new drugs (George, et al., 2001; Rothaermel & Deeds, 2004; Friedman, 2014; The Industry Handbook: Biotechnology, n.d.). Hence, the task is how to create an appropriate "short list" of potential strategic partners for MannKind to market Afrezza? The NAICS code #325412 covers most of the pharmaceutical (pharma) industry and the CI authors do not believe it is reasonable to assume that all of these companies would have the interest or required resources to partner with MannKind (NAICS Association, 2012). Additionally, the resources required to perform "due diligence" on every firm in NAICS code #325412 to create a "short list" of potential strategic alliance firms would be a large task and require large amounts of expertise and money (Barney, 2010; Friedman, 2014; NAICS Association, 2012).

The CI mentions that MannKind CEO, Al Mann has extensive background in making partnership deals with firms; but the CI does not indicate whether MannKind has the internal expertise to create a "short list" of suitable pharma strategic partners or has resources to hire a proper consultant. Kale & Singh (2009) report research studies show that between 30% and 70 % of all strategic alliances fail to meet the goals of the firms involved or deliver the intended benefits. These authors (Kale & Singh, 2009) suggest the best method to improve the chances strategic alliances will be successful is to have firm-level alliance capability. This alliance capability can take the form of knowledgeable individuals, past alliance experience, a dedicated function or a process to accumulate alliance knowledge. The research shows that many of the big pharma firms have one or more of the proper alliance capability attributes. The history of the biotech industry suggests that large pharma firms with an extensive financial, marketing and network base would make the best partners (Barney, 2010; Friedman, 2014). Since "deep pockets" was the apparent CI "short list" selection emphasis, the ten potential partners in CI Table 1 are listed in order of global rank, year 2013 revenue, their global reach (number of operating countries),

and financial health (gross profit margin). CI Table 1 also includes a brief description of these companies' existing diabetes products along with an assessment as to whether any of these products competed with and/or complemented Afrezza.

Recent modification to the Porter's Five Forces model suggests a firm's competitors divide the market among a set of firms while complements increase the size of the firm's market (Porter, 2008; Barney, 2010; Appendix A). Thus, the pharma companies that have product complements should be rated higher on the short list, while those with competing products in their pipeline should be rated lower on the short list. In general, Afrezza competed with insulin products of its own ilk; fast acting – meaning that they began working quickly and lasted a couple of hours (Mannkind Corporation, 2013; Seeking Alpha, 2014). Afrezza complemented insulin products that were long lasting, meaning they were delivered at a steady rate and lasted about one day (Seeking Alpha, 2014). Doctors could prescribe fast acting insulin products like Afrezza together with long lasting insulin products in order to achieve better results for patients. In some cases, Afrezza could actually be considered complementary to other fast acting insulin products if, for example, patients did not respond to one but responded to the other.

Of the 10 companies that were identified in CI, Table 1 as potential partners for MannKind, five were found to have products that directly competed with Afrezza. While this product competition did not remove these five companies from the short list of potential strategic partners, it raised questions about their long-term financial commitment to MannKind. Pfizer and Merck had entered into a partnership to develop Ertugiflozin, an oral diabetes drug that was still in Clinical Trial Phase 3. Ertugiflozin could be used in conjunction with Merck's blockbuster diabetes drug, Januvia, and Afrezza would be in direct competition with both products. AstraZentica's injectable diabetes drug, Exanadtide, was also a competitor for Afrezza; however, it was not yet approved by the FDA. Eli Lily had a fast-acting insulin product, Humalog, which would compete for the same sales as Afrezza. Eli Lily & Co also marketed a product called Humulin that could be considered complementary to Afrezza. Similarly, Novo Nordisk had products in both categories; FIAsp, which was still in Clinical Trial Phase 3, would be in direct competition with Afrezza if approved. Levemir, Novo Nordisk's marketed diabetes product, could potentially complement Afrezza. Another company was identified as having complimentary products to Afrezza; Lantus, Sanofi's long-lasting blockbuster drug. Additionally, Sanofi's drug Apidra could be considered complementary because it had the potential to treat patients who did not respond well to Afrezza (Seeking Alpha, 2014). The authors conclude the short list in CI, Table 1 is a practical and proper starting point for further decision analysis. The three Kale and Singh (2009) critical factors will be the starting place in question # 2 to determine critical success factors based on the short list attributes.

Student Responses

Students in the targeted courses are expected to have the ability to search and identify short lists of strategic partner candidates from secondary sources concerning prior biotech industry strategic alliance decisions. This information should allow the average student to evaluate the relevance and reasonableness of the short list of ten companies provided by the authors in CI, Table 1. One student stretch assignment in the General Discussion and Additional Issues section appeals to higher cognitive levels and require each student to develop their personal short list of

strategic partners and compare their list to CI, Table 1. Students with additional coursework in decision theory might argue any short list approach allows for a bias toward the "usual suspects" that could eliminate potentially effective business partners from consideration in the decision-making process. Perhaps it is beyond the intended scope of the question or students with limited decision theory coursework; however, advanced students might indicate the short list approach would result in "criterion contamination" because the short list creation processes would greatly influence and perhaps pre-determine the success criteria for the decision matrix process.

2. What practical DSS tools could be used to determine critical success factors and feasible alternatives for selection of MannKind's strategic business partners? (LO 2)

This question covers several decision tools to identify suitable selection criteria and alternatives. It provides examples that use appropriate success factors and feasible alternatives to develop an appropriate WADM for MannKind. As stated in the Relevant Theory and Literature section, WADM methods are less sophisticated and less complex than techniques based on portfolio, probability or multi-attribute utility theories but WADM methods can approximate the results of these models (Tague, 2004; Cascio & Boudreau, 2010). Additionally, traditional WADM techniques are more practical because they usually involve only two factors (weighted criteria and alternatives) to determine the best selection. Lack of access to MannKind information concerning the priority, importance or weight of these two factors is an notable constraint; yet, the two weighted factors could be estimated through use of the previously mentioned Fishbone and Force Field methods. These two methods require a list of potential success factors as a starting point to determine the priority of each factor for use in WADM. These success factors are the eight "column headings" in CI, Table 1. Eight factors were reduced to six (see Table 3) to evaluate the ten companies on the short list and became the starting point for each method.

Search for Critical Success Factors

Numerous research studies have been conducted concerning success criteria for single strategic alliances and three factors (partner complementarity, partner commitment and partner compatibility) emerged as a positive influence on SAs performance (Kale & Singh, 2009). These three factors were previously mentioned in the Relevant Theory and Literature section as key drivers of SAs success in the first phase of strategic alliance. Partner complementarity was viewed as the extent to which a partner contributes non-overlapping resources to the relationship; compatibility was the fit between working styles and cultures, and commitment was the willingness of a partner to make short and long-term resource contributions (Kale & Singh, 2009). These researchers (Kale & Singh, 2009) were careful to point out that current research also supports the idea that "order of priority" concerning these three factors was critical to alliance success. For example, the market maturity of the relationship, interdependence between partners and the clarity of cost-benefits between the partners determined the relative importance or priority of the three factors for alliance success (Kale & Singh, 2009). These three success factors uncovered in the literature and their contingencies for strategic partner success serve as the starting place for making recommendations for MannKind concerning the relevance and priority of the aforementioned critical success factors in CI, Table 1 for potential partners.

MannKind Force Field Analysis

A Force Field analysis was developed based on the three Kale & Singh (2009) success categories (see Figure 1). Force Field analysis (FF) is a model that balances forces for change (Driving Forces) and forces against change (Restraining Forces) for diagnosing problems and priority for success factors can be assigned (see Appendix B). The three success factors categories that emerged in the literature as a positive influence on alliance performance (partner complementarity, partner commitment and partner compatibility) are shown in priority order (see Figure 1). Kale & Singh (2009) indicate the commitment category has higher priority over the other two categories when cost-benefits were identified but the allocation process is unclear. Resource commitments could be driving or restraining forces or both because lack of resources have the potential to drive smaller firms toward change and the risk associated with over commitment of resources have the potential for larger firm to hold back on commitments. The complementarity category has a greater impact when one partner is younger than the other is; it involves interdependencies and it is difficult to know what to expect from each other. They are usually driving forces because one firm has what another lacks or needs. The third priority, compatibility has the potential as both driving and restraining forces. It is a driving force when compatibility exists between firms and a restraining force when compatibility does not exist. The research regarding this factor focused on the working styles and cultures of the potential partners and it has been the source of failure for many strategic alliances (Kale & Singh, 2009).

Figure 1: Force Field Diagram for Kale & Singh (2009) Strategic Partner Success
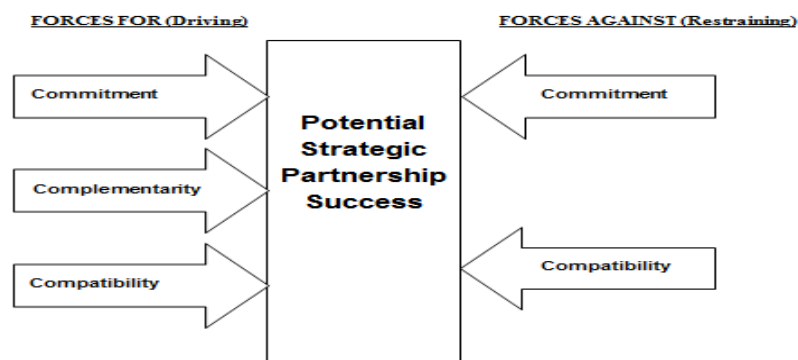
Source: Authors' Notes

The CI indicated many MannKind stakeholders looked forward to a strategic partnership to commercialize Afrezza and protect MannKind from unclear short-term finances. Both internal and external stakeholders in the CI recognized that MannKind's high cash burn rate was unsustainable. The CI authors consider the Commitment category force, short-term cash flow, to be both a driving and restraining force and more important than the long-term financial picture for the pharmaceutical (pharma) partner. A high cash burn rate by MannKind to get the drug developed and approved by the FDA is a strong restraining force but a cash infusion by a strategic partner would be a strong driving force. If Afrezza is successful in the marketplace, the long-term financial picture of both partners should be enhanced and other financing options should be available. Thus, the authors view positive cash flow for MannKind as the most pressing FF goal or success factor for any MannKind strategic partnership. Complementarity forces were deemed second in terms of importance based on the Kale & Singh (2009) research

and the MannKind situation. MannKind is clearly younger in terms of existence and experience than most of the potential pharma partners on the short list discussed in question # 1. Question # 1 mentioned the market size is greater for partners with complementary products and it should be easier for firms with a global marketplace presence to gain regulatory and marketplace success. Moreover, the proximity of the strategic partners has become less important than the technology agglomeration strategies between multinational pharma and biotech firms (Ahn, Meeks, Davenport & Bednarek, 2009). Thus, the complementary nature of the MannKind product could open up opportunities for MannKind and a new pharma partner and provide a larger revenue base for expansion (Barney, 2010; Friedman, 2014). The CI authors view global market presence as a strong driving force that has the potential to provide an alliance with regulatory, marketplace and financial advantages. Due to the completed FDA approval process and experience in the U.S., the marketing and operational needs of potential partners in the U.S. are more known and possibly less risky compared to overseas. Hence, it should be easier for a strategic partnership to overcome required interdependences in the U.S. than overseas and this is viewed as a weaker; yet, important driving force. The CI and question # 1 indicate other diabetes related products have suffered or failed in the marketplace. Again, the most notable market failure was Pfizer's Exubera inhaled insulin product. Since MannKind is a dry powder product with a new delivery system, prior expertise in the diabetes disease is important for the partner that leads the commercialization effort. A high level of diabetes expertise should be a strong driving force but less important than global market presence because MannKind has expertise in this area. The health care network (HCP) of doctors, nurses and others involved with patient education is another complementarity factor but it could be more readily acquired over time than expertise in the diabetes disease process. They would most likely view competing diabetes products by a well-established pharma partner as the least important success factor because it is the most controllable factor. Unless the brand was not established or prior costs on similar diabetes drugs were "sunk cost," most firms would attempt to recover cost on a similar drug. This factor is considered a "driving" force in the FF analysis. Hence, competing products would tend to keep the two companies apart and not form a strategic alliance. As stated before, the compatibility factor has the potential to be both driving and restraining forces. It is a driving force when compatibility exists between firms and a restraining force when compatibility does not exist. However, little information is available from published sources concerning this potentially important success factor. The authors used group team brainstorming and brain writing to determine the priority for each of the six success factors. Each major success factor in CI, Table 1 was mapped into the three success factors uncovered in the literature and shown in TN, Table 1 with appropriate FF categories.

Table 1: Prioritized Success for MannKind Scenario

Six Partner Success factors	Kale & Singh Categories	Force Field Category	Factor Priority
Positive Cash flow	Commitment	Strong Driving, Restraining	1
Global market presence	Complementarity	Strong Driving	2
Content diabetes knowledge	Complementarity	Strong Driving	3
Established HCP contacts	Complementarity	Average Driving	4
U.S. market presence	Complementarity	Weak Driving	5
No competing diabetes products	Complementarity	Average Restraining	6

Source: Authors' Notes

MannKind Fishbone Analysis

The primary focus of the Fishbone Chart is to discover the major influences or "causes" of a problem (see Appendix B). Traditional Fishbone Charts attempt to summarize multiple causes into four major bones or categories (machines, material, methods and manpower or people). These four (M) categories can be modified to fit the specific type of problem and the three categories of success factors found in the literature (commitment, complementarity and compatibility) were used as major "bones" or categories in the authors' Fishbone (see Figure 2).

Figure 2: MannKind Partnership Fishbone Diagram
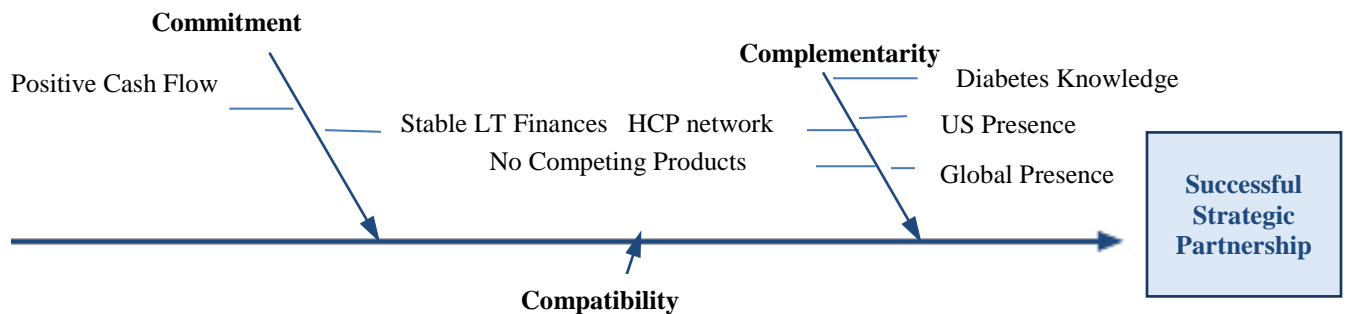
Source: Authors' Notes

The previously discussed six MannKind success factors that were mapped into the three categories of success factors in Table 1 are displayed together in Figure 2. The CI and previous TN analysis suggests the highest priority cash flow factor was a SWOT strength and became a weakness as MannKind burned cash to develop Afrezza. The Fishbone "Commitment" category (see Figure 2) contains the positive cash flow success factor and might become a major strength. A cash infusion from a SAs partner or equity markets should stabilize company long-term finances. The "Complementarity" category in Figure 2 included all the other MannKind success factors, each contained SWOT strengths, and weaknesses except the "No competing diabetes products" factor that are SWOT threat & opportunity categories. Kale & Singh (2009) noticed

that firms managing SAs from a portfolio view have an advantage in managing overlapping resources and offer added benefit in a firm's portfolio rather than compete. A biotech example might be a new drug that targets a specific disease in one SAs might acquire technology or capability in another alliance that enhances the cost-effectiveness of that same drug. The Relevant Theory and Literature section indicated that a large number of strategic alliances fail. Thus, "No competing diabetes products" become an opportunity for the strategic alliance to find new markets; however, a less than stellar new product might drain precious resources and cause failure. The authors developed independent Fishbone and SWOT analyses and used brainstorming and brain writing methods to develop composite SWOT categories listed in Table 2. The more detailed potential strategic partner SWOT information in Appendix A is not required to develop and analyze Figure 2, but it is available to support the previous discussion and Table 2.

Table 2: Priority Summary of Success Criteria

Six Partner Success Factors	SWOT Category	Force Field Category	Factor Priority
No competing diabetes products	Threat/Opportunity	Restraining	6
U.S.market presence	Strength/Weakness	Driving	5
Positive Cash flow	Strength/Weakness	Driving, Restraining	1
Established HCP contacts	Strength/Weakness	Driving	4
Global market presence	Strength/Weakness	Driving	2
Content diabetes knowledge	Strength/Weakness	Driving	3

Source: Authors' Notes

Figure 3: Student Modified Fishbone
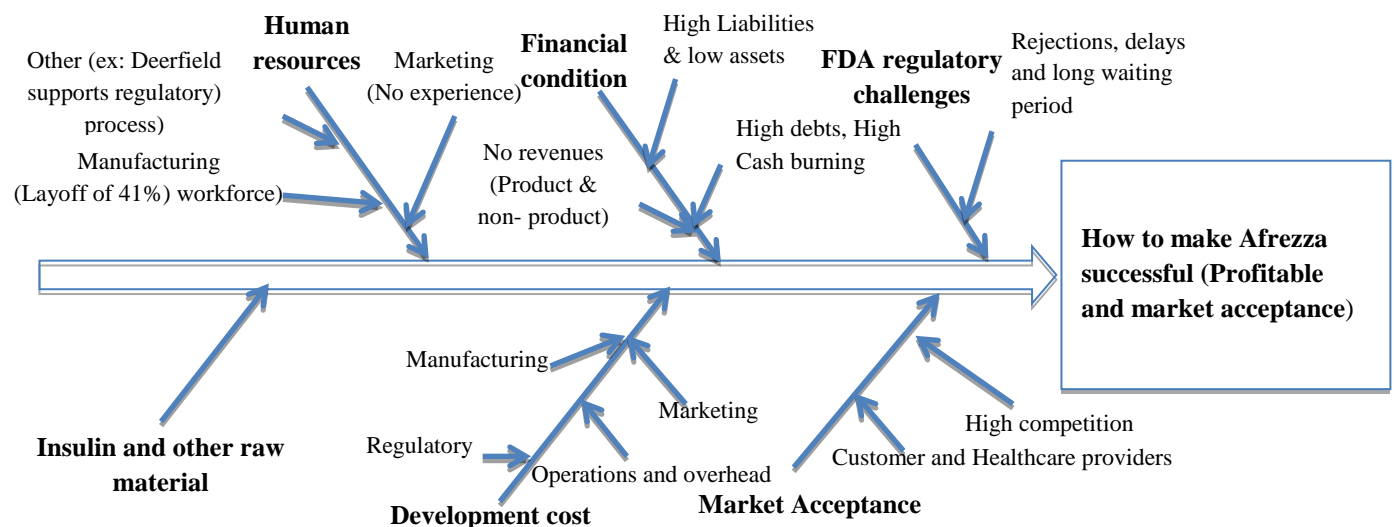
Source: Student class exercise

Student Responses

Students are expected to have basic SWOT knowledge and be able to use Fishbone and Force Field models covered in most targeted courses to develop their own responses. Masters level biotech students in one author's class were given a brief version of the MannKind scenario background and one student developed a Fishbone analysis for MannKind prior to FDA approval (see Figure 3). Figure 3 includes more success factors than postulated by the CI authors and the priority of items was shown on the Fishbone in a different sequence. The authors' Fishbone showed the highest priority category (Commitment) farthest away from the head of the fish and the student's Fishbone showed highest priority items closest to the "head" of the fish. The student's item priority was: 1) FDA regulatory challenges, 2) Market acceptance, 3) Financial condition, 4) Development cost, 5) Human resources and 6) Insulin and other raw materials. The student's analysis focuses on the firm's selection of the best strategic partner before FDA approval. Therefore, after FDA approval, challenge # 1 (FDA regulatory challenges) in the student analysis can be removed for comparison to the CI authors' list of success factors. As a result, market acceptance and financial condition become the top issues and support the priorities indicated by the CI authors. Another student completed an extra credit project concerning the MannKind scenario after FDA approval and added a "compatibility" concern. This student suggested MannKind should perform "due diligence" on this important factor prior to moving forward with any strategic alliance. The above-average performing student's conclusion is consistent with the authors' assertions about success factors and the Kale and Singh (2009) research concerning compatibility.

3. What decision-making tools can be used to select the best strategic partner for MannKind? (LO 3)

As previously mentioned, insufficient information exists in the MannKind CI and public sources to use more complex and comprehensive, multi-attribute utility theory methods to select the best strategic partner for MannKind. When it is necessary to narrow down a long list of options to one final choice based on several different criteria, one less complex version of utility models, namely the decision matrix method can be a useful tool (Tague, 2004; Cascio & Boudreau, 2010). Therefore, a streamlined WADM decision matrix approach based on two (weighted success criteria and weighted alternatives) factors will be used to develop and defend the authors' selection for MannKind. An expected "short list" of potential strategic partners was discussed in question # 1 and CI, Table 1. In most instances, metrics for company attributes were available from public sources. When metrics were unavailable, estimates or proxies were used to rank the attributes (see Table 3). For example, cash flow reports for non-U.S. companies were not consistently available and gross profit numbers were available; thus, they were used as proxies. The exact amount and content of diabetes knowledge was not available; however, it could be estimated from the types of FDA approved diabetes products. The number of health care providers (HCP) in the company network was available in public sources for seven of the ten companies on the short list discussed in question # 1. HCP metrics for the remaining three companies were estimated. It is noted again that eight success factors exist in column headings of CI, Table 1 and they were reduced to six factors because two success factors contain the same data. The "US Rank" and "Revenue USD $M" factors in CI, Table 1 contain the same proxy data and are combined in Table 3 as item # 5. Since yes or no responses to the "Competing

Products and Complementary Products" factors contain the same proxy information, they are combined in Table 3 as item # 6.

Table 3: Prioritized Success for MannKind Scenario

Six Prioritized Success factors	Direct measure or proxy
1. Positive Cash flow	Gross profit
2. Global market presence	Global rank
3. Content diabetes knowledge	Product descriptions
4. Established HCP contacts	Number paid health care providers
5. U.S. market presence	U.S. rank and $ revenue
6. No competing diabetes products	Yes or no competing products/complementary products

Source: Authors' Notes

Application of the Streamlined, Weighted Average Matrix Method

In the streamlined weighted average matrix (WADM) approach, each company on the short list becomes an alternative and needs to be assigned an appropriate weight (rank). All ten companies shown on the CI, Table 1 short list were prioritized, weighted or ranked (1= high, 10 = low) in terms of achieving each critical success factor shown in TN, Tables 1 and 2. As mentioned in question # 2, priority weights (1= high, 6=low) were assigned for each critical success factor (see Tables 1 and 2). The weighted average or "value" for each alternative (company) is the priority weight (1-6) multiplied by the rank assigned (1-10) to each company for each success criteria and a sample template for each WADM score is provided in Table 4. Thus, the first "cell" or space in Table 4 is reserved for rank = (1-10) and the second cell is reserved for the weight = (1-6) of the success factor and the two scores are multiplied to develop a sub-score. These sub-total scores in Table 4 for each company are added horizontally to achieve a total score for the company. Since the value 1= high or best value for success criteria and company rankings, the companies with the lowest weighted average score is the best choice. If MannKind followed this WADM process described above, they would be able to rank all ten companies on their short list according to criteria that is most important to them and select the best strategic partner to market Afrezza. A sample manual WADM computation for one company (Roche) is provided in Appendix B as a guide to how WADM scores for all ten potential strategic partners in Table 5 were calculated. Additionally, a sample Excel formula for Roche can be found in Appendix B for readers that desire this level of specificity. Each co-author independently used the template in Table 4 and information from the CI to develop a decision matrix. Scores for each author were averaged for each firm to create the WADM composite scores and rankings (see Table 6).

Although Pfizer emerged with the best (lowest) WADM score, all top five company scores were close and these results suggests that MannKind could select any one of the top five companies as a successful strategic partner. Of course, new information or unknown factors in one of the high priority items could change the best choice. If information concerning "compatibility" category items such as organizational culture and management style become available, past research on strategic partners suggest these could be "tie-breakers" because many deals have failed based on these compatibility items (Kale & Singh, 2009). Perhaps this type and level of incompatibility

would be discovered in the "due diligence" process prior to signing agreements (Carleton & Lineberry, 2004). Another area that could change the best selection based on the decision matrix approach is the structure of the deal. For example, the amount of cash, timing and structure of the royalties paid could make potential strategic partners with large cash flow more favorable.

Table 4: Decision Matrix Template for Selection of Potential Partners

Success Factors	Positive Cash flow		Global market presence		Content diabetes knowledge		Established HCP contacts		U.S. market presence		No competing diabetes products		Total Scores	
Company/ Weight	1		2		3		4		5		6		Score	Rank
Johnson & Johnson														
Novartis														
Roche														
Pfizer														
Sanofi														
Merck														
GlaxoSmithKline														
AstraZeneca														
Eli Lilly & Co														
Novo Nordisk														

Source: Authors Notes

Table 5: Sample Decision Matrix for Selection of Potential Partners

Success Factors Company/Weight	1. Positive Cash flow		2. Global market presence		3. Content diabetes knowledge		4. Established HCP contacts		5. U.S. market presence		6. No competing diabetes products		Total Scores Score Rank	
A	B	C	D	E	F	G	H	I	J	K	L	M	N	O
Johnson & Johnson	1	1	1	2	6	3	3	4	4	5	5	6	83	2 (Tie)
Novartis	2	1	2	2	5	3	7	4	5	5	3	6	93	4
Roche	3	1	3	2	9	3	4	4	2	5	2	6	75	1
Pfizer	4	1	4	2	8	3	1	4	1	5	8	6	91	3
Sanofi	5	1	5	2	2	3	4	4	8	5	1	6	83	2 (Tie)
Merck	6	1	6	2	3	3	5	4	3	5	10	6	123	6
GlaxoSmithKline	7	1	7	2	10	3	4	4	6	5	4	6	120	5
AstraZeneca	8	1	8	2	7	3	2	4	9	5	9	6	152	9
Eli Lilly & Co.	9	1	9	2	4	3	6	4	7	5	6	6	134	7
Novo Nordisk	10	1	10	2	1	3	4	4	10	5	7	6	141	8

Source: Authors Notes

Table 6: Authors' Composite WADM Scores

Company	Total Scores	
	Score	Rank
Pfizer	73	1
Roche	74	2
Johnson & Johnson	74	2 (tie)
Sanofi	85	4
Novartis	89	5

Source: Authors Notes

Student Responses

As previously mentioned, insufficient data exist in the CI to use complex quantitative decision theory (DSS) approaches. The streamlined WADM is a straightforward weighted average calculation that requires only basic mathematics and decision-making knowledge. Since students

in the targeted courses are expected to have working knowledge of basic math and decision-making methods, they should be able to calculate WADM scores based solely on data provided in the CI. Thus, students should be able to create a table similar to the sample information in Table 5. Decision model examples (see Table 10, Appendix B) were covered in one author's fall 2014 graduate biotech class and students were able to make basic WADM calculations. Due to an accelerated class format, students were asked to focus on developing Force Field and Fishbone Chart skills and they were not asked to calculate a WADM for MannKind. Instead, the class included decision-making exercises in FF and Fishbone methods and a sample student response was shown in question # 2.

Students in strategy courses might attempt to use other versions of the WADM approach to select the best strategic partner for MannKind. Numerous standard strategy textbooks cover decision matrix approaches such as the popular Quantitative Strategic Planning Matrix (QSPM) and the External Factor Evaluation (EFE) Matrix (David, 2009; Appendix B). Students in these strategy classes might suggest QSPM to select the best alternative given critical internal and external success factors (internal and external) and the attractiveness of alternatives (weight or priority) of these factors for each strategic management alternative. The QSPM method requires use of specific practical methods such as EFE, IFE and CFM for success factors and models such as SWOT, BCG, SPACE, IE and GSM to determine the weights and priorities for alternatives (David, 2009). When these specific models are not available, the less comprehensive but acceptable form of industry quantitative analysis, EFE matrix might be considered (David, 2009). This method can be used with specific firms and industries such as biotech. EFE starts with a list of external factors rated from (1-4) separated into SWOT opportunity and threat categories. Factor weights between (0-1) are assigned based on the relative importance of a factor for success in an industry. A weighted average score above the total list's midpoint is deemed an attractive firm within an industry (David, 2009). Again, SWOT analysis is a potential information source for the external factors; however, an industry analysis would be necessary to assign the relative importance of the factors for success in the industry. The results from the QSPM or EFE methods could be compared to the results generated by the less complex WADM method used by the authors or students. The similarities and differences in results should lead to engaging discussion and perhaps stretch exercises similar to examples in the General Discussion and Additional Issues section.

Above average performing students with a background in strategic management should be aware the strategic management literature has increasingly mentioned addition of a sixth force "complements" to the traditional Porter's Five Forces model (see Appendix B). Complements are defined as a product, service, or competency that adds value to the original product offering when the two are used in tandem (Barney, 2010; Rothaermel, 2015). The CI mentioned that Afrezza had the potential to complement other insulin products. In this scenario, a strategic partner would benefit greatly from the addition of Afrezza to their product portfolio. Students with strong quantitative expertise might suggest MannKind spend additional resources to develop the appropriate data to conduct utility analysis. It might be beyond the intended scope of this question; but, students with advanced quantitative and computer skills might offer the options modelling and integer programming approaches. These advanced techniques are consistent with the evolving portfolio management approach mentioned in the strategic management research literature (Kale & Singh, 2009).

General Discussion and Additional Issues

Three discussion questions previously discussed are associated with appropriate learning outcomes (LOs) to provide suitable frameworks and methods for selecting a short list of appropriate strategic partners, the appropriate selection criteria and selecting the best strategic business partner to market their first FDA approved product. Since the CI indicates stakeholders expect certain firms to appear on MannKind's strategic partnership short list and the Relevant Theory and Literature section reveals the same firms appear on most strategic alliance short lists for the biotech industry, question # 1 focuses whether the ten "usual suspects" should appear on MannKind's short list. Question # 2 focuses on relevant screening criteria for selecting the best strategic partner and question # 3 focuses on decision-making methods and components from questions # 1 and # 2 to select MannKind's best strategic partner.

Relevant Theory and Literature

This decision-based critical incident (CI) focuses on strategic decision-making during the marketing or commercialization phase of the biotechnology (biotech) life cycle. The context is strategic alliance formation and the specific application is the decision-making process for making alliances successful. Hence, the appropriate frameworks, models, concepts and tools that allow readers to screen potential strategic partners for commercial success of MannKind's FDA approved product and selection of the best strategic business partner is emphasized in the learning outcomes (LOs) and discussion questions (DQs). The following discussion will provide the theoretical and research context and support for each LO and associated DQs.

Strategic Alliance Formation and Success

The broader context for strategic decision-making can be found in the resource-based view (RBV) of the firm that suggests a firm's boundaries and competitive advantage are determined by its knowledge bases and competencies (Wheelen & Hunger, 2006; Hitt, Ireland & Hoskisson, 2009; David, 2009; Rothaermel, 2015). The organizational behavior and management literature asserts external and internal analyses are traditional approaches for predicting firm success; there are important advantages and disadvantages of both external and internal analysis and neither analysis should be overlooked (Osland, Kolb, Rubin & Turner, 2007). The strategic management literature covers the value chain decision continuum. Strategic management scholars often view "make" or "buy" decisions at opposite ends of the value chain integration decision continuum and view the aforementioned "internal vs. external" analysis for firm success to also sit between these two ends of the decision continuum (Hitt et al., 2009; David, 2009; Rothaermel, 2015).

Strategic alliances (SAs) are voluntary arrangements between firms that involve the sharing of knowledge, resources, and capabilities with the intent of developing processes, products, or services together (Gulati, 1998; Wheelen & Hunger, 2006; Hitt et al., 2009; David, 2009; Kale & Singh, 2009; Jones & George, 2013; Rothaermel, 2015). Strategic alliance strategies have become increasingly popular because they usually facilitate investment in transactions based (buy or external) decisions without encountering the administrative costs (make or internal) of

owning firms (Rothaermel, 2015). The strategic management literature suggests the "scope" of SAs sits on a continuum between the contractual arrangements between business partners and the equity arrangements they develop (Kale & Singh, 2009). The SAs arrangements that define inter-firm relationships are flexible and take many forms such as long-term contracts, licensing, joint ventures and mergers & acquisitions (Kale & Singh, 2009; Rothaermel, 2015). Licensing is a popular form of long-term contracting for strategic alliances that enables firms to commercialize intellectual property and gain the functional advantages owned by another firm (Rothaermel, 2015). Hence, licensing agreements are a popular type of strategic alliances found in the biotech industry where intellectual property such as patents are commercialized to gain the functional advantages owned by another firm such as marketing and manufacturing (Friedman, 2014; Rothaermel, 2015). Where equity arrangements exist, they range from equity swaps and joint ventures to mergers & acquisitions (M&A) to define inter-firm relationships. Joint ventures fit in the middle of the continuum as part contractual and part equity and tend to be more popular than M&A in biotech. Usually, joint ventures allow pharmaceutical (pharma) and biotech partners to maintain control and remain separate entities while M&A move the partners toward one entity. M&A activity is part of the previously mentioned value-chain decision integration and many strategic management scholars believe M&A equity arrangements have very different organizational and decision-making modes from other forms of strategic alliances due to factors such as control, ownership and independence (Kale & Singh, 2009; Rothaermel, 2015). Kale & Singh (2009) denote "success" of strategic alliances depends on the phase of the alliance life cycle and indicate there are three phases to the SAs life cycle: 1.alliance formation and partner selection, 2. alliance governance and design and 3. post formation alliance management. Kale & Singh (2009) identified key drivers of alliance success for each phase of the life cycle. The CI emphasized the first phase of alliance formation and partner selection. Kale & Singh (2009) identified the key SAs drivers as 1. partner complementarity, 2. partner compatibility and 3. partner commitment. Thus, these three drivers in phase one of the strategic alliance life cycle are used for strategic decision-making.

The MannKind CI and industry literature suggest most small biotech firms that survive find large, stable pharma companies to provide the necessary resources to sustain them (George, Zahra, Wheatley & Khan, 2001; Rothaermel & Deeds, 2004; Friedman, 2014; The Industry Handbook: Biotechnology, n.d.). The CI indicates that only a few large pharma companies were well established and had sufficient funds, health care professional contacts, and a knowledgeable salesforce to help biotech firms achieve a return on their investment for new drug development. Hence, the same firms appear on most short lists for selecting strategic alliances of biotech firms. The short list of potential strategic partners for MannKind was expected by stakeholder and was rather easy to develop from published sources (see CI, Table 1). The more demanding tasks for the TN are to develop relevant selection criteria, select appropriate decision-making models and tools to make the final selection and select the best strategic business partner.

Criteria Selection Models and Tools

The management and decision-making literature indicate that decision-making is one of the key steps in the problem-solving process (Osland, et al., 2007; Jones & George, 2013). If a problem is not properly defined, then the latter steps in the problem-solving process - such as selection of alternatives (decision-making) - will also be tainted. Thus, appropriate success criteria are

needed prior to the development of alternatives and selection of the best alternative. Sophisticated qualitative and quantitative techniques exist to develop relevant criteria. Advanced quantitative techniques have been used in the systematic investigation of innovative activities to determine partner selection criteria for open innovation (Yoon & Song, 2014). These authors, (Yoon & Song, 2014) used advanced quantitative techniques such as morphology analysis and generative topology maps to examine patent information for success criteria to select potential partners. However, less complex and practical approaches such as focus groups, Fishbone analysis and Force Field analysis are used when the appropriate data and software tools are not available to conduct advanced quantitative and qualitative analysis (see Appendix B). Numerous methods including the modified Fishbone method exist to determine the relative importance of these causes, forces, goals or criteria for success. After the success criteria have been identified, criteria can then be prioritized in terms of importance by using standard decision support systems (DSS) tools such as Force Field Analysis, Brainstorming, Pareto Charts and the Issue Priority Matrix (Wheelen & Hunger, 2006; Osland, et al., 2007). Kale & Singh (2009) report that over forty research studies for strategic partner selection between single firms were conducted and three success factors (partner complementarity, commitment and compatibility) are the key success drivers for the SAs formation and partner selection phase of the life cycle. These success factors are a practical place to start with examination of methods to assist MannKind with criteria development and partner selection.

Decision Making Models and Tools

A number of decision-making tools are available to help with selection of the best alternative or strategic partner (see Appendix B). These tools range from complex, quantitative methods to less complex, quantitative and qualitative methods. Sophisticated, complex and comprehensive quantitative decision support system (DSS) approaches beyond the previously mentioned morphology analysis and generative topology maps such as options modelling and integer programming can also be used to evaluate alternatives (Lin & Hsieh, 2004; Wang & Hwang, 2007; Yoon & Song, 2014). Less complex quantitative methods range from portfolio analysis and payoff tables to expected value techniques. Usually these less complicated yet effective quantitative techniques use some form of utility analysis. Utility analysis is the determination of institutional gain or loss anticipated from various courses of action (Cascio & Boudreau, 2010). Various forms of utility analysis based on present value analysis, impact analysis, cost-benefit and decision matrix methods are available to help selecting alternatives (Osland, et al., 2007; David, 2009; Cascio & Boudreau, 2010). Insufficient information regarding MannKind exists in the CI and public sources to use utility theory methods based on net present value analysis, cost-benefit analysis, and impact analysis. However, enough information exists regarding the industry and MannKind to make the less complex decision matrix methods attractive for analysis of the MannKind scenario.

Strategic management authors such as David (2009) offers a decision matrix technique called Quantitative Strategic Planning Matrix (QSPM) to select the best alternative given critical internal and external success factors (internal and external) and the attractiveness of alternatives (weight or priority). The industry specific External Factor Evaluation (EFE) Matrix method could be used with specific firms and industries such as biotech. The SWOT analysis is a potential source of information for the external factors; however, an industry analysis would be

necessary to assign the relative importance of the factors for success in the industry. A more streamlined method for the weighting would provide a more practical approach.

A streamlined weighted average decision matrix (WADM) method is useful in situations where data is limited because only two factors (weighted success criteria and weighted alternatives) are required. The authors contend the core of previously described utility theory, strategy oriented QSPM, and EFE methods can be retained by streamlining the success criteria and weighting factors through use of the Force Field and Fishbone methods. Focus groups, brainstorming and aggregation of independent assessment blended with the Fishbone and Force Field methods can be used to estimate weights derived by more complex quantitative tools (Tague, 2004; Osland, et al., 2007; David, 2009; Jones & George, 2013). Thus, WADM decision matrix methods are used to develop success criteria, alternatives and selection of the best potential strategic partner for MannKind in the questions.

Typical Assignment Timing and Format

Ideally, the CI should be assigned after students have been exposed to strategic models and decision-making methods. Depending on the available class time, each question could be either an individual or a group assignment. For class discussion of short duration (less than ninety minutes), the instructor might consider a brief lecture or handout on topics covered by each question to maximize the class discussion experience. For example, the sample scores in Table 5 could be a student handout or students could be required to calculate their WADM scores outside of class to maximize in-class discussion time of the results.

Advanced Student Questions and Stretch Assignments

Several student stretch assignments are feasible for each question that requires higher levels of cognitive complexity (Bloom's Taxonomy, n.d.). For example, rather than the authors' discussion of the short list in question # 1 based on firms in CI, Table 1, students could be required to develop their personal short list of strategic partners and compare their lists to CI, Table 1 and identical TN, Table 7. Moreover, students could be asked to discuss the origin of any differences in the two lists of strategic partners. The authors provided Figure 1 as an example of how Force Field Analysis could help the decision-making process and both the authors' and student example of the Fishbone methods was offered in Figures # 2 and # 3. Instead, students could be required to select their best decision-making method from a list of methods (see Table 10, Appendix B) provided in the class textbook or lectures. Thus, they could compare their best method to these aforementioned decision-making models and the decision matrix method that was ultimately selected by the authors in question # 2. As previously mentioned, TN, Table 7 content is identical to CI, Table 1 but TN, Table 8 is a more detailed potential strategic partner SWOT analysis. Tables 7 and 8 in Appendix A could be used as handouts to provide additional information regarding product and industry information and enhance discussion of questions # 2 and # 3. The discussion of question # 2 could be further enriched by asking students to discuss whether the SWOT analysis influenced or their prioritized success criteria and their prioritized criteria to the "Factor Priority" in the authors' Table 1. Additionally, students could be asked to discuss whether the pre-selected companies in TN,

Table 7, their success criteria and/or the decision-making method influenced their best strategic partner choice for MannKind.

Epilogue

MannKind selected Sanofi, a French pharmaceutical firm as its strategic partner (MannKind, 2014). Sanofi agreed to pay up to $925 million for the right to market Afrezza and share 35% of the profits or losses from Afrezza with MannKind. MannKind's cash flow was enhanced when they received a $150 million upfront payment with an exclusive Sanofi worldwide collaboration and licensing deal for development and commercialization of Afrezza. This cash infusion allowed MannKind to satisfy the 2013 debt arrangement with Deerfield and since Sanofi's announcement, MannKind stock has moved in both directions. MannKind will be paid as much as $775 million more if the drug meets certain sales and regulatory milestones (Globe Newswire, January 8, 2015). In January 2015 Alfred Mann, the firm's founder, retired from his CEO position and transitioned to Executive Chairman. Several sources indicate Mann intends to remain engaged with MannKind business matters (Global Newswire, January 12, 2015). MannKind's Board of Directors appointed Hakan Edstrom, current MannKind President, as the new CEO and he will retain his title as President (Global Newswire, January 12, 2015). In early February 2015, became available at U.S. pharmacies (Saxena, 2015). Industry observers report that MannKind spent more than a decade and nearly $2 billion developing the drug (Retrieved from http://www.latimes.com/business/la-fi-0812-mannkind-partner-2014012-story.html). Since Afrezza only became available in the first quarter, 2015, detailed information about its sales is not expected until the end of the year. Hence, the long-term impact on the financial viability of MannKind due to the numerous FDA delays and forming the strategic alliance with Sanofi remains an open question.

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Appendix A

Table 7 below is identical content to Table 1 of the CI. This table is repeated in the TN for the convenience of the readers and it serves as a bridge to the SWOT analysis for the same ten companies in Table 8 that follows.

Table 7: Financial Health and Global Positions of Potential Partners (based on data from 2013)

Company Name	Global Rank	US Rank	Revenue (USD $ in Millions)	No. of HCPs Paid	Gross Profit Margin	Diabetes Products Name/Description	Competing Products?	Complementary Products?
Johnson & Johnson	1	5	71,310	97,000	69%	LifeScan Ultra: Blood sugar meter Animas: Insulin pump	No(indirectly) – Invokana	No
Novartis	2	6	56,670	64,500	69%	Starlix: Oral drug	No	No
Roche	3	2	52,310	Not Reported	66%	Accu-Chek: Blood sugar meter	No	No
Pfizer	4	1	51,580	142,600	81%	Exubera: Inhaled insulin (discontinued) Ertugliflozin (Phase 3): Fast-acting oral	Yes – Ertugliflozin	No
Sanofi	5	9	52,300	Not Reported	59%	Lantus: Long-lasting injectable insulin Apidra: Fast-acting injectable insulin	No	Yes – Lantus and Apridra
Merck	6	3	44,000	81,300	62%	Januvia: Oral drug Ertugliflozin (Phase 3): Fast-acting oral	Yes – Januvia and Ertugliflozin	No
GlaxoSmith Kline	7	7	43,900	85,100	68%	Avandia: Oral drug	No	No
AstraZeneca	10	11	25,700	111,2000	77%	Onglyza: Oral drug Komboglyze: Oral drug Farxiga: Oral drug Symlin: Injectable	Yes – Exenatide	No

						Exenatide (Phase 3: Injectable long-lasting		
Eli Lilly & Co.	11	8	23,100	79,000	79%	Humalog: Fast-acting injectable insulin	Yes - Humalog	Yes – Humulin
Novo Nordisk	19	13	15,400	Not Reported	77%	Levemir: Long-lasting injectable insulin	Yes - FIAsp	Yes – Levemir

Sources: (Seeking Alpha, 2014; Ornstein, Grochowski Jones, & and Sagara, 2014; Stock Analysis on Net, 2014; FierceMarkets, 2012)

Table 8: Potential Strategic Partners SWOT Analysis

Company	Strengths	Weaknesses	Opportunities	Threats
Johnson & Johnson	Top Pharma company worldwide with highest revenues indicates aforementioned "deep pockets"	Negative existing reputation as a licensing partner due to previous interaction with Calibra Medical	Bolster sales of diabetes products (devices as opposed to drugs) by strengthening diabetes market presence	Sales of oral diabetes drug, Invokana, would compete indirectly with Afrezza
Novartis	Second leading Pharma company worldwide with a strong global and existing presence in diabetes market	Patents for most profitable products are due to expire	Market Afrezza as new blockbuster drug to replace loss in revenue due to patent expiry	Unresolved bribery lawsuit has damaged company's reputation
Roche	Third leading Pharma company worldwide; second leading company in the US; strong global presence and healthy cash position	Despite exceptional drug development capabilities, so far unsuccessful in bringing a diabetes drug to market	Vertical integration -Bolster blood sugar meter sales by selling Afrezza diabetes drug	Late entrance; heavy saturation of diabetes market makes it difficult to break in - even for well-established companies
Pfizer	Highest profit margin indicates exceptional financial health and ability to market Afrezza	Past failure of inhaled insulin program could indicate inability to successfully market Afrezza	Leverage knowledge of inhaled insulin/lessons learned to successfully market Afrezza	Collaboration with Merck to develop competing diabetes product could indicate conflict of interest
Sanofi	High diabetes market share indicates existing marketing strategy is effective and salesforce is competent	Lowest profit margin potentially indicates sub-optimal financial health	Leverage complementary diabetes products; bolster their sales and the sales of Afrezza	Diabetes products sales stalled due to increased competition
Merck	Third leading Pharma company in the US with a strong existing presence in the diabetes market	Fewest amount of operating countries potentially indicates minimal global reach	Market Afrezza to reinforce image of oral drug superiority over injectable as all diabetes products (new and existing) are oral	Collaboration with Pfizer to develop competing diabetes product plus existing competing diabetes product
GlaxoSmith Kline	Strong global reach based on high number of operating countries	Weak diabetes market presence with only one approved diabetes product; 2 awaiting FDA approval	Market Afrezza to reinforce image of oral drug superiority over injectable as all diabetes products (new and existing) are oral	Heavy saturation of diabetes market makes it difficult to break in – especially for a smaller Big Pharma company
AstraZeneca	High number of approved diabetes products (none are insulin) and a strong global presence based on number of operating countries	Lack of insulin products indicates salesforce will not be as knowledgeable about this specific treatment option; additional resources will be needed to get them "up to speed'	Utilize existing presence in diabetes market to market Afrezza; leverage sales force with proven success of selling diabetes products	Once approved, sales of Afrezza could inhibit company's own diabetes product. Existing injectable insulin product image could be hurt by marketing inhaled insulin

Eli Lilly & Co.	High profit margin indicates exceptional financial health Substantial presence in diabetes market	Lower revenue indicates potential inability to divert enough resources to expeditiously market Afrezza	Utilize existing presence in diabetes market to market Afrezza; leverage complementary diabetes product to bolster sales	Sales of Afrezza could inhibit existing diabetes products Existing injectable insulin product image could be hurt by marketing inhaled insulin
Novo Nordisk	High profit margin indicates exceptional financial health Currently dominates the diabetes market	Lowest revenue indicates potential inability to divert enough resources to expeditiously market Afrezza	Utilize existing presence in diabetes market to market Afrezza; leverage complementary diabetes product to bolster sales	Sales of Afrezza could inhibit existing diabetes products Existing injectable insulin product image could be hurt by marketing inhaled insulin

Source: Authors' Notes

Technical Note

Table 9: Additional Information for Potential Partners

Company Name	Country Headquarters	Number of Operating Countries	2013 Gross Profit (USD $ in Millions)	2013 Diabetes Market Share (worldwide)	Phase III (Not FDA Approved) Diabetes Products Name/Description	Approved Diabetes Products Name/Description
Johnson & Johnson	U.S.	60+	48,970	.4%	Canagliflozin: SGLT2 inhibitor	LifeScan Ultra: Blood sugar meter Animas: Insulin pump
Novartis	Switzerland	140	39,223	3.3%	Tresiba (under FDA review) Semaglutide	Starlix: Oral drug
Roche	Switzerland	150	34,446	0	Aleglitazar Tofogliflozin hydrate	Accu-Chek: Blood sugar meter
Pfizer	U.S.	180	41,998	0	Ertugliflozin (partnership)	Exubera: Inhaled insulin (discontinued) Ertugliflozin (Phase III): Fast-acting oral
Sanofi	France	100+	30,751	22.6%	Lyxumia	Lantus: Long-lasting injectable insulin Apidra: Fast-acting injectable insulin
Merck	U.S.	8	27,079	15.3%	MK-3102 Ertugliflozin (partnership): Oral, fast-acting	Januvia: Oral drug Ertugliflozin (Phase III): Fast-acting oral
GlaxoSmithKline	U.K.	100+	29,698	0	Albiglutide	Avandia: Oral drug

| AstraZeneca | U.K. | 100+ | 19,886 | 0 | Dapagliflozin: Oral Metreleptin (under FDA review): Injectable | Onglyza: Oral drug Komboglyze: Oral drug Farxiga: Oral drug Symlin: Injectable insulin Exenatide (Phase III): Injectable long-lasting |
| Eli Lilly & Co. | U.S. | 70 | 18,210 | 10% | LY2605541 Empagliflozin LY2963016 Dulaglutide | Humalog: Fast-acting injectable insulin |

Source: Seeking Alpha, 2014; Ornstein, Grochowski Jones & Sagara, 2014; Stock Analysis on Net, 2014

Appendix B

Technical Note

Numerous business models exist that could explain the strategic relationship of MannKind to other companies in the biotech industry and potential strategic partners outside biotech. The purpose of this appendix is to expand the amount and depth of information about pertinent models beyond what was covered in the critical incident, Relevant Theory and Literature section and individual discussion questions. Since the discussion questions and learning outcomes focused on strategic decision-making, only strategy and decision models are discussed.

Strategic Management Models

SWOT and Porter's Five Forces are two important and popular models that are used in the selection of strategic alliances. The CI Industry Background information provided ample information for the SWOT analysis discussed in question # 2. Additional SWOT information might be desired to analyze issues in more depth and SWOT could be extended to analyze potential strategic partners (see Appendix A). The Porter's Five Forces model was not a major point of discussion for the MannKind CI. However, the complementary force concept was briefly mentioned in all three discussion questions and it was covered more thoroughly in Appendix A and mentioned again in student stretch assignments.

SWOT Analysis

Wheelen & Hunger (2006) indicate SWOT has proven to be the most enduring analytical method used in strategic management. SWOT formulates, implements and evaluates the strategic success of a firm based on the impact of external (TO) forces (threats and opportunities) and internal (SW) forces (strengths and weaknesses) alone or together. Forces in the SWOT model are usually inter-related and they can be positive or negative. SWOT could be used to analyze major internal and external forces affecting the biotech industry and MannKind since the forces could be analyzed together in the model (Barney, 2010; Rothaermel, 2015). SWOT categories

were mentioned in the CI Industry Background section and were used for mapping the success factor criteria in Table 2. However, SWOT analysis could be extended in a number of useful ways. For example, there are four possible combinations of factors indicated in the traditional SWOT model; utilizing strengths to take advantage of opportunities (SO), using strengths to avoid potential threats (ST), leveraging opportunities to overcome weaknesses (WO), and minimizing weaknesses in order to avoid potential threats (WT). Traditional SWOT analysis assumes all items are equally weighted and this was the assumption in question # 3 when it was used to set priorities for success factors in Table 2. SWOT could be easily weighted and used with several quantitative decision-making methods. For instance, weighting of SWOT items lends itself to quantitative decision-making techniques such as weighted averages and specifically the External Factor Evaluation (EFE) Matrix (David, 2009). The previously discussed Competitive Profile Matrix (CPM) is another weighted average approach that might be considered (Wheelen & Hunger, 2006; David, 2009).

Porter's Five Forces Analysis

The two most commonly used models to evaluate the management of biotech markets are an abbreviated form of PESTLE called PEST (P= political, E= economic, S= social and T= technology) and Porter's Five Forces analysis (Porter, 2008; Friedman, 2014). Since the primary strategic focus was strategic alliance formation, PEST was not featured in the MannKind CI or discussion questions. The Porter model was briefly mentioned in terms of complementary forces in all three discussion question and as a handout for one of the stretch assignments. Porter's model measures the attractiveness and expected performance in an industry based on the threats of buyers, entry, rivalry, substitutes and suppliers. The traditional Porter's Five Forces model is used to understand the external competitive industry context in which firms operate and as a tool to evaluate a firm's strategic position in the industry (Porter, 2008). A list of relevant forces could be added to improve the Porter model. Recent strategy textbooks have increasingly mentioned the addition of a sixth force "complements" to the traditional Porter's Five Forces model (Barney, 2010; Rothaermel, 2015). Complements are defined as a product, service, or competency that adds value to the original product offering when they are used in tandem (Barney, 2010; Rothaermel, 2015). MannKind might improve strategic decision-making by analyzing the value of the delivery device (inhaler) separate from the drug, Afrezza. Additionally, the list of forces in the Porter's Five Forces model could be quantified in a manner that allows decision-makers to give different priorities or weights to each of the five or six factors. Numerical weights instead of categories (High, Moderate, and Low) could be assigned to each factor in Porter's model for the biotech industry or MannKind products (Wheelen & Hunger, 2006; David, 2009). These numerical weights could be used with decision matrices such as WADM to improve decision-making.

Decision Theory Models and Applications

The management and decision sciences literature makes a distinction between the related concepts, problem solving and decision-making. Rational problem solving is deemed a series of steps that help to reduce the difference between the actual situation and the desired situation (Osland, et al., 2007; Jones & George, 2013). These authors (Osland, et al., 2007; Jones &

George, 2013) indicate decision-making is one of the steps for selection of alternatives after the problem is clearly defined. Thus, if a problem is not defined correctly, several sources of contamination and inaccuracy are introduced that render the alternatives and choices ineffective. This concern was raised in the Relevant Theory and Literature section and question # 2 around the issue of criteria contamination for MannKind's selection of a strategic partner. The decision-making started with a pre-determined short list of companies that could introduce selection contamination and risk. In the ideal situation, MannKind would define the problem and success criteria for selection first and then use these factors to choose the best strategic partner from the pool of all available strategic partners. In the "real world" of constraints, problem definition and criteria formulation often start with a more restricted pool of "usual suspects" that taints the process and increases the selection risk.

A number of decision-making tools help to mitigate selection risk. These tools range from complex, quantitative methods to less complex, quantitative and qualitative methods. Sophisticated, complex and comprehensive quantitative decision support system (DSS) approaches such as morphology analysis, generative topology maps, options modelling and integer programming can be used to evaluate decision alternatives (Lin & Hsieh, 2004; Wang & Hwang, 2007; Yoon & Song, 2014). Less complex quantitative methods range from portfolio analysis, payoff tables, and expected value techniques to decision matrices. As mentioned in the discussion questions, these less complicated yet effective quantitative techniques often use some form of utility analysis. Utility analysis is the determination of institutional gain or loss anticipated from various courses of action (Cascio & Boudreau, 2010). Various forms of utility analysis are based on present value analysis, impact analysis, cost-benefit and weighted average techniques that are available to help selecting alternatives (Osland, et al., 2007; David, 2009; Cascio & Boudreau, 2010). Since insufficient information exists in the MannKind critical incident and public information sources to use utility theory methods based on net present value analysis, cost-benefit analysis, and impact analysis, less complex methods such as decision matrices were used. An appropriate discussion of the advantages and disadvantages of each method listed in Table 10 would take several pages that is beyond the intended scope of the TN; therefore, this detailed discussion was not included in Appendix B. The methods or tools appropriate for discussion question # 2 were covered in one authors' class in biotech management together with the advantages and disadvantages of each method (see Table 10). Additionally, the practical issues involved with each method and extension of each method were also explored in class. Several tool extensions that could help with selection of the best strategic partner are described. The essence of previously described utility theory, QSPM and EFE methods can be maintained by streamlining the success criteria and weighting factors through use of the Force Field and Fishbone methods. Focus groups, brainstorming and aggregation of independent assessment combined the Fishbone and Force Field methods can be used to estimate the weights derived by more comprehensive, quantitative tools (Tague, 2004; Osland, et al, 2007; David, 2009; Jones & George, 2013). These less complex and more practical approaches to decision matrix methods were used to develop success criteria, alternatives and select the best potential strategic partner for MannKind.

Table 10: Popular Decision- Making Models

Methods	Advantages	Disadvantages
1.Brain storming & Brain writing		
2.Delphi		
3.Nominal Group		
4.Milestone & Gantt		
5.Force-Field		
6.Fishbone		
7.Pareto		
8.Decision Matrix & Grid		
9.Expected Value		
10.Net Present Value		

Source: Author's Notes

Force Field Analysis

Force Field analysis focuses on two opposing forces: driving forces that promote change or restraining forces that resist change (Osland, et al., 2007). Force Field analysis (FF) is a change model that balances forces for change (Driving Forces) and forces against change (Restraining Forces) for diagnosing problems in a manner that can assign priority to success factors. Change occurs when the number and intensity (magnitude and importance) of driving forces exceed those of the resistant forces that support the status quo. The FF model can be expanded in terms of the factors, intensity of the forces as well as the category of forces for change. The MannKind FF was developed with the three categories of success factors that emerged in the literature as a positive influence on alliance performance (partner complementarity, partner commitment and partner compatibility). This method was used in discussion question # 2 to map factors found in the strategic planning literature to the success factors listed in the short list of potential strategic partners. Figure 1 and Table 2 incorporated the FF and students expanded the model with application to MannKind.

Fishbone Diagram

Numerous methods including the Fishbone method exist to determine the relative importance of causes, forces, goals or criteria for success. The Relevant Theory and Literature section indicated that after the success criteria has been identified, criteria can then be prioritized in terms of importance by using standard decision support systems (DSS) tools such as Force Field Analysis, Brainstorming, Pareto Charts and the Issue Priority Matrix (Wheelen & Hunger, 2006; Osland, et al., 2007). The primary focus of the Fishbone Chart is to discover the major influences or "causes" of a problem. Traditional Fishbone Charts attempt to summarize causes into four major categories (machines, material, methods and manpower or people). The categories that are closer to the head of the fish are usually higher priority. However, these four (M) categories and sequence of items for priority can be modified to fit the specific type of problem. The three Kale & Singh (2009) categories of success factors are found in the CI and relevant literature (commitment, complementarity and compatibility). These categories were

used in the authors' Fishbone in priority order (see Figure 2). The Forced Field, Fishbone and SWOT methods were used individually and in tandem to verify the priority of forces for MannKind included in discussion question # 2 (see Table 2). As part of a class exercise, one student used different factors to evaluate the priority of items for MannKind. However, the student's conclusion is consistent with the CI authors' assertions about success factors and the Kale and Singh (2009) research (see Figure 3).

Weighted Average Decision Matrix for Strategy Planning

A specific form of weighted average decision matrix is often used in strategic planning textbooks and by practitioners is the External Factor Evaluation (EFE) Matrix (David, 2009). EFE starts with a list of external factors rated from (1-4) separated into opportunity and threat categories. For ease of calculations, factor weights between (0-1) are assigned based on the relative importance of a factor for success in an industry. A weighted average score above the midpoint of the total list is deemed an attractive firm within an industry (David, 2009). Similarly, decision support systems (DSS) theory can be used by replacing weights in the EFE model with probabilities or expected values (EV). These methods were mentioned are decision-makers that wanted to focus on the strategic aspect of decision-making and have more access to company data than the authors' access to MannKind data.

Streamlined Weighted Average Decision Matrix

Since numerous forms of the weighted average exist for decision-making, the streamlined decision matrix (WADM) approach is attractive in situations where little company data exist because only two factors (weighted success criteria and weighted alternative) are required. Thus, the streamlined WADM method was selected for MannKind's selection of the best strategic partner in discussion question # 3. Each alternative is ranked on a numerical scale and the WADM value of each is the sum ($\sum$) of the multiplication (X or *) of the priority or numerical ranking of each success criterion and the numerical ranking of each alternative. If the scale for ranking alternatives and weights starts with high =1, the lowest WADM is the best alternative and if the lowest priority starts with 1, the largest WADM is the best alternative. The priority weights were (1= high, 6=low) for each critical success factor and the ranking were (1-10) for each company in the Table 4 template. The manual computation for the firm (Roche) with the best (lowest) score is, $WADM = \sum(4X1) + (3X2) + (9X3) + (4X4) + (2X5) + (2X6) = 75$).In addition to the weights (1-6) in each column, two letters (B-M) were assigned to each column sub-heading in Table 5 to facilitate use of Excel. Additionally, the Excel formula to calculate WADM for Roche is, N5= (B5*C5)+(D5*E5)+(F5*G5)+(H5*I5)+(J5*K5)+(L5*M5), where the upper case letters (B-M) represent the value in each column in Table 5. A sample list for all ten potential strategic partners with ratings, weights and total WADM scores was displayed in Table 5. Since only two raters (co-authors) were involved, inter-rater reliability was not considered and the two WADM scores were averaged to arrive at the composite WADM scores in Table 6.