T2+2™ Market Overview

Beeswax

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Beeswax is a natural wax produced by bees to build the combs in which they live.[1] Its primary application has historically been in the cosmetics industry, where it is generally used for its "emulsifying and consistency regulating properties," often as part of a beeswax/borax system.[2] Cosmetics applications, when added to pharmaceutical applications (beeswax is used to coat pills and to allow for the time-release of medicines),[3] make up approximately 70% of the overall beeswax market.[4] The remaining 30% of the market is divided between numerous applications. These include:

- Candles (driven in part by the Roman Catholic Church's preference for beeswax candles);[5]
- Metal casting, molding and modeling;[6]
- Textiles (used for waterproofing);[7]
- Wood and leather polishes and finishes;[8] and,
- Industrial lubricants.[9]

Beeswax derives many of its unique properties from its composition. Beeswax has a high complex polyester content, which gives it much of its plastic character, and these polyesters are extremely viscous, which gives beeswax much of its oil-retention capability. The polyesters are augmented by hydroxy fatty acids to make it a superior sealant. Additionally, beeswax contains flavenoids that make it less susceptible to oxidation and micro-organisms.[10]

While market sizes are hard to estimate, the following provides our insight into the global beeswax market:

Market Niche Size			
Market Size in Tons	***Growth Rate***	***Base Year***	***Detailed Basis for Estimate***

[1] "The Production & Processing of Beeswax." Fain's Honey web site. http://www.fainshoney.com/beeswaxProduction.asp (accessed July 7, 2009).
[2] Rit, A.W. Peters et al. "A New Beeswax Derivative for Cosmetic Formulations." Koster Keunen web site. http://www.kosterkeunen.com/News/customer-files/Cera%20Bellina.pdf (accessed July 7, 2009).
[3] Sivasubramaniam, Lakshmi. "Beeswax: It's Good, Bad and Ugly." November, 2005. Pharmainfo web site. http://www.pharmainfo.net/reviews/beeswax-its-good-bad-and-ugly (accessed July 7, 2009).
[4] "Beeswax: A Useful and Valuable Product." FAO Corporate Document Repository web site. http://www.fao.org/docrep/006/y5110e/y5110e07.htm (accessed July 7, 2009).
[5] "History of Candles." Sweet Springs Candles web site. http://sweetspringscandles.com/History_of_Candles/History_of_Candles.html (accessed July 7, 2009).
[6] Sivasubramaniam, Lakshmi. "Beeswax: It's Good, Bad and Ugly." November, 2005. Pharmainfo web site. http://www.pharmainfo.net/reviews/beeswax-its-good-bad-and-ugly (accessed July 7, 2009).
[7] Ibid.
[8] "Organic Beeswax." Koster Keunen web site. http://www.kosterkeunen.com/Products/products.asp?ProductsID=84&CategoryID=21 (accessed July 7, 2009).
[9] "Beeswax: A Useful and Valuable Product." FAO Corporate Document Repository web site. http://www.fao.org/docrep/006/y5110e/y5110e07.htm (accessed July 7, 2009).
[10] Rit, Ton Peters and Robert Behrer. "Beeswax Through the Ages." Koster Keunen web site. http://www.kosterkeunen.com/News/customer-files/Beeswax%20Through%20The%20Ages.pdf (accessed July 7, 2009).

56,865 tons	-0.16%	2007	These estimates are taken from the Food & Agriculture Organization of the United Nations. It was derived by that organization through the aggregation of the beeswax production estimates of all the countries in the world.[11] Please note that the growth rate is the 2003-2007 growth rate, and is not forward looking. We were unable to find a forward-looking growth rate estimate.

Although the growth rate of the beeswax market appears to have been flat between 2003 and 2007, this is somewhat deceiving as the market had increased to 61,237 tons in 2006 before declining over 7% to its 2007 level.[12] As of July 7, 2009, the price of a one pound cake of white beeswax was $5.62; however, this could not be used to determine a dollar value of the beeswax market as it is a wholesale price and is only for one of the many grades of beeswax.[13]

Market size and growth rate are a function of the number of people in the market and the anticipated rate of buying. As markets transition between emerging, growth, shakeout, mature, and declining, the basis for competition and the number of competitors usually changes, along with the factors influencing adoption of innovation. The number of and growth rate for customers suggests how many units might be sold.[14]

Our Current View on the Phase of the Market	
Today	***Trend***
Mature	Mature

Our research indicates that the beeswax market is mature. The production of beeswax is well understood, as it has been used since the era of the ancient Egyptians.[15] Furthermore, the market is stable, with virtually no growth. This combination of dominant design and flat growth is generally indicative of a mature market. It should be noted that despite the significant drop in beeswax production between 2006 and 2007 we do not believe this to be a declining market, as our research indicates that this was the result of supply side factors, such as a widespread bee die-off, rather than a decrease in demand.[16]

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[11] "FAOSTAT." Food and Agriculture Organization of the United Nations web site. http://faostat.fao.org/site/569/DesktopDefault.aspx?PageID=569#ancor (accessed July 7, 2009).
[12] Ibid.
[13] Telephone conversation with receptionist at Dadant & Sons, (217) 847-3324, July 7, 2009.
[14] For a detailed discussion of the "innovativeness dimension," see Everett M. Rogers, *Diffusion of Innovations*, 4th ed. (New York: Free Press, 1995). For further readings related to market phases and innovation, see also James Utterback, *Mastering the Dynamics of Innovation* (Boston: Harvard Business School Press, 1996) and Vijay K. Jolly, *Commercializing New Technologies: Getting from Mind to Market* (Boston: Harvard Business School Press, 1997).
[15] Sutherland, Roger & Mary Sutherland. "Beeswax- Its History and Uses." Honeyflow Farm web site. http://www.honeyflowfarm.com/articles/beeswax.php (accessed July 7, 2009).
[1616] Odlum, Sally. "The Honey Bee Crisis of 2007." February 17, 2007. *Vegetable Gardens.* Suite 101 web site. http://vegetablegardens.suite101.com/article.cfm/the_honey_bee_crisis_of_2007 (accessed July 7, 2009).

Markets can also be described in terms of the basis for competition (best technological performance, best value or the price/performance tradeoff that best matches the end-users' preferences, lowest cost, or best availability or the ability to get the product quickly). This dimension helps to define the context in which a commercialization strategy must be developed.

Basis for Competition in the Arena	
Today	***Trend***
Lowest Price	Lowest Price

Beeswax appears to be a commodity, with the market setting a single price for each of the different varieties and purities. Numerous organizations, including Bees for Development,[17] ICIS,[18] and the Food and Agriculture Organization of the United Nations[19] refer to beeswax as a commodity, and point to a single market price. As a result, the basis for competition is solely price.

In each market there may be stakeholders and companies with significant market share that will influence the introduction of your technology. Some organizations or companies that will likely influence the introduction of this technology are the following:

Examples of Major Competitors in the Arena		
Competitor	***Relevance***	***Web site***
Koster Keunen	Distributor of 17 families of wax products, including organic, non-organic and siliconyl beeswax.[20]	http://www.kosterkeunen.com
Strahl & Pitsch	Claims to be the leading refiner of beeswax in the U.S.[21]	http://www.spwax.com
Brushy Mountain Bee Farm	Thirty year-old producer of beeswax and beeswax products based in North Carolina.[22]	http://www.bushymountainbeefarm.com
Dadant & Sons	Claims to be the oldest and largest domestic distributor of beekeeping supplies. Sells beeswax as well as many	http://www.dadant.com

[17] Wendorf, Horst. "Why Bother Beekeeping?" Bees for Development web site. http://www.beesfordevelopment.org/info/info/people/why-bother-beekeeping.shtml (accessed July 7, 2009).
[18] "Beeswax Market in Supply Pinch in Wake of Production Problems." March 2, 1998. http://www.icis.com/Articles/1998/03/02/86597/beeswax-market-in-supply-pinch-in-wake-of-production.html (accessed July 7, 2009).
[19] "Beeswax: A Useful and Valuable Product." FAO Corporate Document Repository web site. http://www.fao.org/docrep/006/y5110e/y5110e07.htm (accessed July 7, 2009).
[20] Koster Keunen web site. http://www.kosterkeunen.com (accessed July 7, 2009).
[21] Strahl & Pitsch web site. http://www.spwax.com/spbeeswa.htm (accessed July 7, 2009).
[22] "About Us." Brushy Mountain Bee Farm web site. http://www.brushymountainbeefarm.com/Aboutus.asp (accessed July 7, 2009).

	other products, and publishes the American Bee Journal.[23]	
Ross Waxes	Sells blocks, prills, slabs and cakes of beeswax for cosmetic, pharmaceutical and other applications.[24]	http://www.frankbross.com

Examples of Key Stakeholders or Networking Channels with Contact Information		
Stakeholder	***Relevance***	***Contact Information***
Apimondia	Apimondia is the International Federation of Beekeepers Associations. It seeks to promote the economic and scientific development of apiculture (beekeeping) on a global scale.[25]	Corso Vittorio Emanuele 101 I-00186 Roma, Italy Tel.: +39 066852286 http://www.apimondia.org
American Beekeeping Federation (ABF)	Represents beekeepers to the Federal government and runs the American Honey Queen honey promotional program.[26]	3525 Piedmont Rd. NE, Bldg. 5 Suite 300 Atlanta, GA 30305-1509 Tel: (404) 760-2875 http://www.abfnet.org
Bees for Development	Organization founded to develop beekeeping as an economic engine in third world countries.[27]	PO Box 105 Monmouth NP25 9AA, UK Tel: +44 16007-13648 http://www.beesfordevelopment.org
American Association of Professional Apiculturists (AAPA)	Organization of researchers and entomology professors specializing in bees, honey and beeswax.[28]	Tel.: 765-494-4605 Email: ghunt@purdue.edu http://www.masterbeekeeper.org

Entry barriers are obstacles that remove customer segments from the market for some period of time. They limit the size of the addressable market in general or the market share that can be captured. These barriers must be overcome or avoided to have a successful market entry. Our work to date suggests the following entry barriers may prevent customer segments from buying this type of technology for some period of time.

Market Entry Barriers	
Name of Barrier	***Description/Why***
Use of Synthetic Chemicals in Beekeeping Degrades Quality	The price garnered by beeswax is tied directly to the quality of the wax. One of

[23] Dadant & Sons web site. http://www.dadant.com (accessed July 7, 2009).
[24] "Beeswax." Ross waxes web site. http://www.frankbross.com/beeswax.htm (accessed July 7, 2009).
[25] Apimondia website. http://www.apiservices.com/apimondia/index_us.htm (accessed July 7, 2009).
[26] "What is the ABF?" American Beekeeping Federation web site. http://www.abfnet.org/node/4 (accessed July 7, 2009).
[27] "About Us." Bees for Development web site. http://www.beesfordevelopment.org/info/about/index.shtml (accessed July 7, 2009).
[28] "AAPA Membership Directory." American Association of Professional Apiculturists. http://www.masterbeekeeper.org/aapa/members_active.htm (accessed July 7, 2009).

of Wax	the primary ways that wax production can be negatively affected is through the use of synthetic agents for pest control or other purposes.[29] As synthetic pest control agents are generally cheaper and easier to use than alternatives, this like is a barrier to potential new entrants to the beeswax market, especially given that one of the major issues the apiculture industry is dealing with today is a devastating varroa mite infestation.[30]
Cost of Beeswax Compared to Synthetic Waxes	Beeswax is more expensive than many comparable products, largely because demand generally outstrips supply and because it takes approximately eight pounds of honey to produce one pound of beeswax.[31] As a result, unless beeswax is needed specifically, a less expensive synthetic substitute can often be used,[32] which is likely a barrier for the market.

As beeswax is a commodity, the barriers in the market seem relatively low when compared to other markets. This is because price is the most important factor in a commodity market; when prices are low, there is little impetus for new players to enter the market.

Market drivers are forces that strengthen or weaken the importance of end-user needs over time. Practice level drivers are micro-economic; they affect the end-user directly. They influence the selection of substitutable goods and thus affect market share. Arena level drivers affect the organizations and industrial sectors in which the end-users work. They influence the overall demand for goods like this technology and its substitutes. They affect when and how much of the total addressable market is actually going to be in the market and buying.

Market Drivers	
Name of Driver	***Why Significant***
Colony Collapse Disorder	Since 2006, honey bees have been dying off at a high rate across the U.S. No cause for this die-off has been determined, and it is currently being called "Colony Collapse Disorder."[33] As many as 20% of the country's bees perished during the winter of 2007-2008.[34] This represents a significant loss to beekeepers, and will likely result in a long-term drop in U.S. beeswax production.

[29] Bogdanov, Stefan. "Quality and Standards of Pollen and Beeswax." 2004. *Apiacta*. Apimondia web site. http://www.apimondia.org/apiacta/articles/2003/bogdanov_1.pdf (accessed July 7, 2009).
[30] Bessin, Ric. "Varroa Mites Infesting Honeybee Colonies." University of Kentucky Entomology web site. http://www.ca.uky.edu/entomology/entfacts/ef608.asp (accessed July 7, 2009).
[31] "Beeswax Candles." Beelite Candles web site. http://www.beelitecandles.com/Why%20Beeswax.pdf (accessed July 7, 2009).
[32] Strahl & Pitsch web site. http://www.spwax.com/spbeeswa.htm (accessed July 7, 2009).
[33] "Bees and Pollination." The Ohio State University web site. http://www.oardc.ohio-state.edu/agnic/bee/ccd.htm (accessed July 7, 2009).
[34] Flottum, Kim. "Disease Crippling Biggest Bee Hives." June 11, 2008. The Daily Green web site. http://www.thedailygreen.com/environmental-news/blogs/bees/colony-collapse-disorder-55061103_ (accessed July 7, 2009).

Increasing Honey Prices	In 2008, honey prices more than doubled.[35] As it takes eight pounds of honey to produce one pound of beeswax, such increases have a significant effect on the cost of beeswax production and beeswax prices.[36]
Potential for New Applications	The unique properties of beeswax have made it a target of much research into alternative uses. One example is a technology developed at NASA that uses beeswax microcapsules to help clean up oil spills.[37]Another is a groundwater treatment developed at Savannah River National Laboratory.[38] Such new applications may serve to drive new demand for beeswax moving forward.

As with any agricultural product, producers of beeswax are significantly affected by forces outside of their control, and recently those forces have been mostly negative. However, the possibility of new uses for beeswax outside of the traditional cosmetic and pharmaceutical markets is a silver lining, as it could result in increased demand.

Here are some additional data and sources that can help you better understand the market.

Name	*Description*
"Beeswax Through the Ages"	This article, from producer Koster Keunen, contains detailed data on the chemical composition and properties of beeswax. View it at the following URL: http://www.kosterkeunen.com/News/customer-files/Beeswax%20Through%20The%20Ages.pdf
Country-by-Country Beeswax Production	The Food and Agriculture Organization of the United Nations has an excellent data resource on their web site that allows users to see the production of numerous types of agricultural products, including beeswax, in most countries in the world. View it a the following URL: http://faostat.fao.org/site/569/default.aspx#ancor

[35] Flottum, Kim. "Why the Price of Honey More than Doubled." June 18, 2008. The Daily Green web site. http://www.thedailygreen.com/environmental-news/blogs/bees/colony-collapse-disorder-55061804?src=rss (accessed July 7, 2009).
[36] "Beeswax Candles." Beelite Candles web site. http://www.beelitecandles.com/Why%20Beeswax.pdf (accessed July 7, 2009).
[37] "Tech Transfer: From Bees to Booms." Industrial Equipment News web site. http://www.ien.com/article/tech-transfer-from/4366 (accessed July 7, 2009).
[38] "Groundwater and Wastewater Remediation Using Agricultural Oils." Savannah River National Laboratory web site. http://www.srs.gov/general/busiops/tech-transfer/techbrif/GroundH2OPassive.pdf (accessed July 7, 2009).