

# Where to Start? Adding Objectivity to the Profit Apportionment Process in Reasonable Royalty Calculations

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## I. Introduction

On September 27, 2013, when determining a reasonable royalty in *In re Innovatio IP Ventures, LLC Patent Litig.*, Judge Holderman employed a somewhat unusual methodology called the “Top-Down Approach.”<sup>1</sup> It was offered at trial by damages expert Dr. Gregory Leonard.<sup>2</sup> Judge Holderman turned to the Top-Down Approach because he found that there were no comparable licensing agreements on which to base a reasonable royalty.<sup>3</sup> In applying this methodology, Judge Holderman apportioned the operating profits of the smallest salable patent-practicing unit using an economic study written by Mark Schankerman.<sup>4</sup> In this study, Mark Schankerman determined the relative value of patent protection by technology field using a variation of a patent renewal model that was originally developed by himself and Ariel Pakes in 1984.<sup>5</sup> The particular finding from this study that Judge Holderman relied on was that “the top 10% of all electronics patents account for 84% of the value in all electronics patents.”<sup>6</sup>

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<sup>1</sup> *In re Innovatio IP Ventures, LLC Patent Litig.*, No. 11-C-9308, 2013 U.S. Dist. LEXIS 144061, at \*162-83 (N.D. Ill. Sept. 27, 2013).

<sup>2</sup> *Id.* at \*162.

<sup>3</sup> *Id.* at \*160 (“In light of the absence of any comparable licenses, the court will consider other methods that the parties proposed for determining the RAND rate that the parties would have agreed to in the hypothetical negotiation.”).

<sup>4</sup> *Id.* at \*181 (citing Mark Schankerman, *How Valuable is Patent Protection? Estimates By Technology Field*, 29 RAND J. ECON. 77, 94 tbl.5 & n.12 (1998), available at <http://www.jstor.org/stable/2555817>).

<sup>5</sup> Schankerman, *supra* note 4, at 79. A patent renewal model uses data on patent renewal rates and fees to derive quantitative estimates of the private value of patent protection. *Id.* The original patent renewal model is described in Ariel Pakes & Mark Schankerman, *The Rate of Obsolescence of Patents, Research Gestation Lags, and the Private Rate of Return to Research Resources*, in R & D, PATENTS, AND PRODUCTIVITY 73 (Zvi Griliches ed., 1984), available at <http://www.nber.org/chapters/c10045>.

<sup>6</sup> *Innovatio*, 2013 U.S. Dist. LEXIS 144061, at \*181 (citing Schankerman, *supra* note 4, at 94 tbl.5 & n.12).

Judge Holderman’s opinion along with Judge Robart’s opinion in *Microsoft Corp. v. Motorola, Inc.*,<sup>7</sup> have received significant attention because they establish a framework for evaluating reasonable and non-discriminatory (“RAND”) licensing commitments.<sup>8</sup> However, this paper will focus on the specific methodology employed by Judge Holderman, the Top-Down Approach, and how it can be modified to more reliably estimate a reasonable royalty when there are no comparable licensing agreements.

Under 35 U.S.C. § 284, if a court finds that a patent was infringed, it must “award the [patent owner] damages adequate to compensate for the infringement, but in no event less than a reasonable royalty for the use made of the invention by the infringer.”<sup>9</sup> Despite the broad language of § 284, patent owners “tend to try to fit their damages cases into the ‘lost profits’ framework.”<sup>10</sup> Under this framework, a patent owner ““must show causation in fact, establishing that but for the infringement, he would have made additional profits.”<sup>11</sup> A lost profits award is generally preferable because it “is above and beyond the reasonable royalty floor required by the statute.”<sup>12</sup>

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<sup>7</sup> *Microsoft Corp. v. Motorola, Inc.*, No. 10-1823 JLR, 2013 U.S. Dist. LEXIS 60233 (W.D. Wash. Apr. 25, 2013).

<sup>8</sup> Several courts have used the framework they developed for evaluating RAND licensing commitments. *See, e.g.*, *Commonwealth Sci. & Indus. Research Organisation v. Cisco Sys.*, No. 6:11-cv-343, 2014 U.S. Dist. LEXIS 107612 (E.D. Tex. July 23, 2014); *Realtek Semiconductor Corp. v. LSI Corp.*, No. C-12-3451-RMW, 2014 U.S. Dist. LEXIS 81673 (N.D. Cal. June 16, 2014); *Golden Bridge Tech. v. Apple Inc.*, No. 5:12-cv-04882-PSG, 2014 U.S. Dist. LEXIS 68564 (N.D. Cal. May 18, 2014); *GPNE Corp. v. Apple, Inc.*, No. 12-CV-02885-LHK, 2014 U.S. Dist. LEXIS 53234 (N.D. Cal. Apr. 16, 2014). However, the method for establishing RAND rates remains an open and controversial issue in patent law. *See, e.g.*, *Kassandra Maldonado, Breaching RAND and Reaching for Reasonable: Microsoft v. Motorola and Standard-Essential Patent Litigation*, 29 *BERKELEY TECH. L.J.* 419 (2014); *Yoonhee Kim, Lifting Confidentiality of FRAND Royalties in SEP Arbitration*, 16 *Colum. Sci. & Tech. L. Rev.* 1 (2014).

<sup>9</sup> 35 U.S.C. § 284 (2012).

<sup>10</sup> *Mars, Inc. v. Coin Acceptors, Inc.*, 527 F.3d 1359, 1366 (Fed. Cir. 2008) (citing Donald S. Chisum, *Chisum on Patents* § 20.01 (2005); Herbert F. Schwartz, *Patent Law and Practice*, 212 (5th ed. 2006)).

<sup>11</sup> *Calico Brand, Inc. v. Ameritek Imps., Inc.*, 527 Fed. Appx. 987, 995 (Fed. Cir. 2013) (quoting *Siemens Med. Solutions USA, Inc. v. Saint-Gobain Ceramics & Plastics, Inc.*, 637 F.3d 1269, 1287 (Fed. Cir. 2011)). *See also* *Wechsler v. Macke Int'l Trade, Inc.*, 486 F. 3d 1286, 1293 (Fed. Cir. 2007)); *Rite-Hite Corp. v. Kelley Co., Inc.*, 56 F.3d 1538, 1544 (Fed. Cir. 1995) (en banc).

<sup>12</sup> *Apple Inc. v. Motorola, Inc.*, 757 F.3d 1286, 1327 n.6 (Fed. Cir. 2014).

In the event that the patentee is unable to show causation, the most common approach for calculating a reasonable royalty is the hypothetical negotiation or the “willing licensor-willing licensee” approach.<sup>13</sup> This methodology “attempts to ascertain the royalty upon which the parties would have agreed had they successfully negotiated an agreement just before infringement began.”<sup>14</sup> Unfortunately, even with the guidance provided by the *Georgia-Pacific* factors,<sup>15</sup> the Federal Circuit has described the hypothetical negotiation as “a difficult judicial chore, seeming often to involve more the talents of a conjurer than those of a judge.”<sup>16</sup>

The *Georgia-Pacific* factors “tie the reasonable royalty calculation to the facts of the hypothetical negotiation at issue,”<sup>17</sup> but they do not provide a numerical starting point.<sup>18</sup> It is

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<sup>13</sup> *Lucent Techs., Inc. v. Gateway, Inc.*, 580 F.3d 1301, 1324 (Fed. Cir. 2009).

<sup>14</sup> *Id.* (citing *Georgia-Pacific Corp. v. U.S. Plywood Corp.*, 318 F.Supp. 1116, 1120 (S.D.N.Y. 1970); *Rite-Hite*, 56 F.3d at 1554 n.13; *Radio Steel & Mfg. Co. v. MTD Prods., Inc.*, 788 F.2d 1554, 1557 (Fed. Cir. 1986); *Panduit Corp. v. Stahl Bros. Fibre Works, Inc.*, 575 F.2d 1152, 1159 (6th Cir. 1978)). *Accord* *VirnetX, Inc. v. Cisco Sys.*, 767 F.3d 1308, 1326 (Fed. Cir. 2014).

<sup>15</sup> The *Georgia-Pacific* factors are a non-exhaustive list of relevant evidentiary facts that include: (1) the “royalties received by the patentee for the licensing of the patent in suit,” (2) the “rates paid by the licensee for the use of other patents comparable to the patent in suit,” (3) the “nature and scope” of a hypothetical license, (4) the “licensor’s established policy and marketing program to maintain his patent monopoly by not licensing others to use the invention or by granting licenses under special conditions designed to preserve that monopoly,” (5) the “commercial relationship between the licensor and licensee,” (6) the “existing value of the invention to the licensor as a generator of sales of his non-patented items,” (7) the “duration of the patent and the term of the [hypothetical] license,” (8) the “established profitability of the product made under the patent; its commercial success; and its current popularity,” (9) the “utility and advantages of the patent property over the old modes or devices,” (10) the “nature of the patented invention . . . and the benefits to those who have used the invention,” (11) the “extent to which the infringer has made use of the invention,” (12) the “portion of the profit or of the selling price that may be customary in the particular business or in comparable businesses to allow for the use of the invention or analogous inventions,” (13) the “portion of the realizable profit that should be credited to the invention as distinguished from non-patented elements,” (14) the “opinion testimony of qualified experts,” and (15) the “amount which a prudent licensee – who desired, as a business proposition, to obtain a license to manufacture and sell a particular article embodying the patented invention – would have been willing to pay as a royalty and yet be able to make a reasonable profit and which amount would have been acceptable by a prudent patentee who was willing to grant a license.” *Georgia-Pacific*, 318 F.Supp. at 1120.

<sup>16</sup> *Fromson v. Western Litho Plate & Supply Co.*, 853 F.2d 1568, 1574 (Fed. Cir. 1988) *Accord* *ResQNet.com, Inc. v. Lansa, Inc.*, 594 F.3d 860, 869 (Fed. Cir. 2010); *Trell v. Marlee Electronics Corp.*, 912 F.2d 1443, 1447 (Fed. Cir. 1990).

<sup>17</sup> *Uniloc USA, Inc. v. Microsoft Corp.*, 632 F.3d 1292, 1317 (Fed. Cir. 2011).

<sup>18</sup> See Liane M. Peterson, Note, *Grain Processing and Crystal Semiconductor: Use of Economic Methods in Damage Calculations Will Accurately Compensate for Patent Infringement*, 13 FED. CIRCUIT B.J. 41, 70 (2003) (“[T]he

widely accepted that royalties paid or received in licenses for the patent in suit or in comparable licenses provide the best numerical starting point for a hypothetical negotiation.<sup>19</sup> However, there are many times when this type of evidence is not available. In these situations, courts will often look to the relevant profit margin.<sup>20</sup> The question then becomes how to allocate that profit between the patent owner and the infringer. Historically, the “25 percent rule of thumb” and the “analytical approach” have been used to allocate profit. Unfortunately, as will be discussed in more detail in the next section, the “25 percent rule of thumb” is arbitrary and the “analytical approach” does not provide a complete solution.

In this paper, I attempt to address the specific problem of calculating a reasonable royalty rate when there are no comparable license agreements by slightly modifying the Top-Down Approach used by Judge Holderman in *Innovatio*. My goal was to find a way to use patent statistics to provide a meaningful starting point to the hypothetical negotiation. The novel contribution of this paper is the proposal to use objective indicators of value, such as forward citations and backward citations, in combination with a patent renewal model to calculate an initial reasonable

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*Georgia-Pacific* factors do not provide numerical evidence of what the parties would have actually agreed to had they decided to enter into a licensing agreement prior to the start of the infringement period.”).

<sup>19</sup> *Apple*, 757 F.3d at 1325 (“As we have held many times, using sufficiently comparable licenses is a generally reliable method of estimating the value of a patent.”); *LaserDynamics, Inc. v. Quanta Computer, Inc.*, 694 F.3d 51, 79 (Fed. Cir. 2012) (“Actual licenses to the patented technology are highly probative as to what constitutes a reasonable royalty for those patent rights because such actual licenses most clearly reflect the economic value of the patented technology in the marketplace.”); *Nickson Indus., Inc. v. Rol Mfg. Co.*, 847 F.2d 795, 798 (Fed. Cir. 1988) (“Where an established royalty exists, it will usually be the best measure of what is a ‘reasonable’ royalty.”).

<sup>20</sup> *See, e.g.*, *Brunswick Corp. v. United States*, 36 Fed. Cl. 204 (Fed. Cl. 1996); *Insituform Techs., Inc. v. Cat Contr., Inc.*, 518 F. Supp. 2d 876 (S.D. Tex. 2007); *Monsanto Co. v. Strickland*, 604 F. Supp. 2d 805 (D.S.C. 2009); *Northlake Mktg. & Supply, Inc. v. Glaverbel, S.A.*, 72 F. Supp. 2d 893 (N.D. Ill. 1999); *Novozymes A/S v. Genencor Int’l, Inc.*, 474 F. Supp. 2d 592 (D. Del. 2007) (relying heavily on an expert’s opinion that allocated profit); *Syntex (U.S.A.) Inc. v. Paragon Optical, Inc.*, 1987 U.S. Dist. LEXIS 14544 (D. Ariz. Nov. 23, 1987); *Ziggity Systems, Inc. v. Val Watering Systems*, 769 F. Supp. 752 (E.D. Pa. Sep. 27, 1990).

royalty rate.<sup>21</sup> I also go one step further than most papers on the subject of damages calculations and apply my proposed methodology to a hypothetical lawsuit.

Section II will review the established techniques for calculating a reasonable royalty that involve apportioning profit. Section III will describe the Top-Down Approach as it was applied by Judge Holderman in *Innovatio*. Finally, Section IV will describe my proposed methodology and apply it to a hypothetical lawsuit.

## **II. Established Techniques for Apportioning Profit**

The “25 percent rule of thumb” and the “analytical approach” are two common profit apportionment techniques that have been used to calculate a reasonable royalty.

### **A. The 25 Percent Rule of Thumb**

The 25 percent rule of thumb suggests that a licensee in a hypothetical negotiation would be willing to “pay a royalty rate equivalent to 25 per cent of its expected profits for the product that incorporates the IP at issue.”<sup>22</sup> An underlying assumption is that “the licensee should retain a majority (i.e., 75 per cent) of the profits because it has undertaken substantial development, operational and commercialization risks, contributed other technology/IP and/or brought to bear

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<sup>21</sup> I found one paper that comes close to proposing this idea. See Jonathan A. Barney, *A Study of Patent Mortality Rates: Using Statistical Survival Analysis to Rate and Value Patent Assets*, 30 AIPLA Q. J. 317 (2002). However, instead of using a patent renewal model to apportion value, Jonathan Barney simply uses it to illustrate the fact that “[a] relatively large number of patents appear to be worth little or nothing while a relatively small number appear to be worth a great deal.” *Id.* at 329. The primary goal of his paper was to develop a methodology for calculating an “IPQ score” for a particular patent. *Id.* at 334-35. His “IPQ score” is similar in nature to the value index I refer to in the third step of my methodology. *Id.* It is also worth noting that Jonathan Barney has obtained several patents related to calculating this IPQ score. See U.S. Patent No. 6,556,992 (filed Sep. 14, 2000); U.S. Patent No. 7,657,476 (filed Dec. 21, 2006); U.S. Patent No. 7,716,226 (filed Sep. 27, 2005); U.S. Patent No. 7,949,581 (filed Sep. 7, 2006); U.S. Patent No. 7,962,511 (filed Apr. 29, 2003); U.S. Patent No. 8,131,701 (filed Mar. 29, 2010); U.S. Patent No. 8,504,560 (filed Mar. 2, 2012); U.S. Patent No. 8,818,996 (filed Aug. 2, 2013).

<sup>22</sup> Robert Goldscheider, John Jarosz and Carla Mulhern, *Use Of The 25 Per Cent Rule in Valuing IP*, 37 LES NOUVELLES 123, 123 (Dec. 2002), available at <http://www.bu.edu/otd/files/2009/11/goldscheider-25-percent-rule.pdf>.

its own development, operational and commercialization contributions.”<sup>23</sup> The rule focuses on the licensee’s expected operating profits “because it is the licensee who will be using the IP.”<sup>24</sup> An empirical study conducted by Robert Goldscheider, John Jarosz, and Carla Mulhern in 2002 showed that “across all industries, the median royalty rate as a percentage of average operating profits was 22.6 per cent.”<sup>25</sup> The study concluded that the rule is “is best used as one pricing tool and should be considered in conjunction with other (quantitative and qualitative) factors that can and do affect royalty rates.”<sup>26</sup>

Critics of the 25 percent rule of thumb argue that it is arbitrary and point out that the median royalty rate as a percentage of average operating profits varied wildly amongst the fourteen industries examined in the previously mentioned study.<sup>27</sup> Furthermore, in *Uniloc USA, Inc. v. Microsoft Corp.*, the Federal Circuit held that “[e]vidence relying on the 25 percent rule of thumb is [] inadmissible under *Daubert*<sup>28</sup> and the Federal Rules of Evidence, because it fails to tie a reasonable royalty base to the facts of the case at issue.”<sup>29</sup> The Federal Circuit explained that “there

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<sup>23</sup> *Id.* at 124.

<sup>24</sup> *Id.* Operating profits are defined as “revenues minus: 1) cost of goods sold and 2) non-manufacturing overhead.” *Id.* at 125.

<sup>25</sup> *Id.* at 133.

<sup>26</sup> *Id.*

<sup>27</sup> *See, e.g.*, John Skenyon, Christopher Marchese, and John Land, Patent Damages Law and Practice § 3:35 (2014) (“While the profit margins or operating profits of the parties in suit might have some relevance on the damages issue, it is difficult to justify factoring into the equation general operating profit numbers for at least 14 totally unrelated industries, particularly where the actual royalty, as a percentage of profits, varied widely from industry to industry. For example, in the semiconductor industry, the royalty as a percentage of profit is only 7.8%, but in a damages analysis, that would get raised to 25% by the ‘rule’ because in the automotive industry the royalty as a percentage of profit is 44.1% and the two numbers average out to about 25%”) (citing Goldscheider et al., *supra* note 22, at 130 fig.8).

<sup>28</sup> 509 U.S. 579 (1993).

<sup>29</sup> *Uniloc USA, Inc. v. Microsoft Corp.*, 632 F.3d 1292, 1315 (Fed. Cir. 2011). *See also* *Douglas Dynamics, LLC v. Buyers Prods. Co.*, 717 F.3d 1336, 1346 (Fed. Cir. 2013); *Energy Transp. Group, Inc. v. William Demant Holding A/S*, 697 F.3d 1342, 1356 (Fed. Cir. 2012); *Whitserve, LLC v. Computer Packages, Inc.*, 694 F.3d 10, 30 (Fed. Cir. 2012).

must be a basis in fact to associate the royalty rates used in prior licenses to the particular hypothetical negotiation at issue in the case.”<sup>30</sup> The 25 percent rule of thumb fails this requirement because it is “an abstract and largely theoretical construct.”<sup>31</sup>

## **B. The Analytical Approach**

Technically, the analytical approach is separate and distinct from the hypothetical negotiation approach, but it is a widely accepted approach to calculating a reasonable royalty that involves the apportionment of profit.<sup>32</sup> Under the analytical approach, the projected operating profit is apportioned between the infringer and the patent owner by giving the usual industry operating profit on the item to the infringer and the rest to patent owner.<sup>33</sup> The Federal Circuit first recognized the analytical approach in *TWM Mfg. Co. v. Dura Corp.*, where it affirmed the judgment of the district court, adopting a report of a special master.<sup>34</sup> In her report, the special master relied principally on a memorandum written by “Dura’s top management” projecting “a gross profit averaging 52.7% from its infringing sales.”<sup>35</sup> Next, she calculated the anticipated

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<sup>30</sup> 632 F.3d at 1317.

<sup>31</sup> *Id.*

<sup>32</sup> *Wordtech Sys., Inc v. Integrated Networks Solutions, Inc.*, 609 F.3d 1308, 1319 (Fed. Cir. 2010) (“A reasonable royalty can be calculated from an established royalty, the infringer’s profit projections for infringing sales, or a hypothetical negotiation between the patentee and infringer based on the factors in *Georgia-Pacific* . . .”); *Lucent Techs., Inc. v. Gateway, Inc.*, 580 F.3d 1301, 1324 (Fed. Cir. 2009) (“Litigants routinely adopt several approaches for calculating a reasonable royalty. The first, the analytical method, focuses on the infringer’s projections of profit for the infringing product. . . . The second, more common approach, called the hypothetical negotiation or the ‘willing licensor-willing licensee’ approach, attempts to ascertain the royalty upon which the parties would have agreed had they successfully negotiated an agreement just before infringement began.”). *See also* John Skenyon et al., *Patent Damages Law & Practice* § 3:8 (2014); *Energy Transp. Group, Inc. v. William Demant Holding A/S*, 697 F.3d 1342, 1357 (Fed. Cir. 2012) (approving an expert’s alternative use of the analytical approach).

<sup>33</sup> *TWM Mfg. Co. v. Dura Corp.*, 789 F.2d 895 (Fed. Cir. 1986). *See also* John Skenyon et al., *Patent Damages Law & Practice* § 3:8 (2014). Two district court cases that rely, in part, on the analytical approach include *Novozymes A/S v. Genencor Int’l, Inc.*, 474 F. Supp. 2d 592 (D. Del. Feb. 16, 2007), and *Polaroid Corp. v. Eastman Kodak Co.*, 1990 U.S. Dist. LEXIS 17968, 16 U.S.P.Q.2D (BNA) 1481 (D. Mass. Oct. 12, 1990).

<sup>34</sup> *TWM*, 789 F.2d 895.

<sup>35</sup> *Id.* at 899.

operating profit range by subtracting the overhead expenses from that figure.<sup>36</sup> Lastly, she subtracted “the industry standard [operating] profit of 6.56% to 12.5% from that anticipated [operating] profit range” to arrive at a 30% reasonable royalty rate.<sup>37</sup> On appeal, Dura argued that “the special master erred as a matter of law in failing to analyze all factors delineated in *Georgia-Pacific*.” The Federal Circuit rejected this argument stating that “Section 284 does not mandate how the district court must compute . . . [a reasonable royalty], only that the figure compensate for the infringement.”<sup>38</sup>

Unlike the 25 percent rule of thumb, the analytical approach is still alive and well. However, there are certain deficiencies with the analytical approach that this paper seeks to address.<sup>39</sup> First, the rule as formulated and applied in *TWM* inherently attributes all of the excess operating profit above the usual industry operating profit to one patent. This may have been acceptable in *TWM*,<sup>40</sup> but this is not always the case.<sup>41</sup> Some sources have described the analytical

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<sup>36</sup> *TWM*, 789 F.2d at 899. The special master’s opinion technically refers to “net profit.” However, net profit is defined as the “[t]otal sales revenue less the cost of the goods sold and all additional expenses,” whereas operating profit is defined as the “[t]otal sales revenue less all operating expenses” with “no adjustment being made for any nonoperating income and expenses, such as interest payments.” *Profit*, in BLACK’S LAW DICTIONARY (9th ed. 2009). Since the special master’s opinion only accounts for operating expenses, the term “operating profit” is more appropriate.

<sup>37</sup> *Id.*

<sup>38</sup> *Id.* (citing *Aro Manufacturing Co. v. Convertible Top Replacement Co.*, 377 U.S. 476, 507, 141 U.S.P.Q. (BNA) 681, 694, 12 L. Ed. 2d 457, 84 S. Ct. 1526 (1964)).

<sup>39</sup> At least one court has criticized analytical approach. *Johns-Manville Corp. v. Guardian Indus. Corp.*, 718 F. Supp. 1310, 1313-14 (E.D. Mich. 1989) (“There are myriad problems with using . . . [the analytical] approach in this case. First, the analytical approach as applied by J-M produces an absurd result even in the estimation of J-M’s experienced licensing expert. . . . Second, the analytical approach is not well-suited to process patent (as opposed to product patent) infringement where practicing the patent simply results in production of a fungible item at a decreased expense, thus merely reducing variable costs. . . . Third, J-M’s malleable application of the analytical approach to Guardian’s business plans reflects the high degree of uncertainty associated with using tentative projections in an industry where economies of scale benefits are so important.”).

<sup>40</sup> *TWM*, 789 F.2d at 900-01.

<sup>41</sup> *VirnetX, Inc. v. Cisco Sys.*, 767 F.3d 1308, 1326 (Fed. Cir. 2014) (citing *LaserDynamics, Inc. v. Quanta Computer, Inc.*, 694 F.3d 51, 67-68 (Fed. Cir. 2012)) (“[W]hen claims are drawn to an individual component of a multi-component product, it is the exception, not the rule, that damages may be based upon the value of the multi-component product.”)

approach as including a step where the excess profits are apportioned, but this still leaves courts with the difficult and often imprecise task of apportioning profit.<sup>42</sup> Second, since the analytical approach is separate and distinct from the hypothetical negotiation analysis, it loses some of the flexibility that is built into the hypothetical negotiation analysis.<sup>43</sup> In particular, the bargaining position of the parties is not directly accounted for in the analytical approach.<sup>44</sup> The Top-Down Approach as it was applied by Judge Holderman in *Innovatio* addresses many of the problems associated with the 25 percent rule of thumb and the analytical approach.

### **III. How the Top-Down Approach was applied in *Innovatio***

Starting back in 2011, Innovatio IP Ventures, LLC (“Innovatio”) sued numerous coffee shops, hotels, restaurants, supermarkets, large retailers, transportation companies, and other commercial users of wireless internet technology located throughout the United States.<sup>45</sup> Innovatio alleged that, by providing wireless internet access to their customers or using it to manage internal processes, these wireless network users infringed various claims of twenty-three patents owned by Innovatio.<sup>46</sup> In response, several manufactures, including: Cisco Systems, Inc., Motorola Solutions, Inc., SonicWALL, Inc., Netgear, Inc., and Hewlett–Packard Co., filed declaratory judgment actions against Innovatio seeking a declaration that Innovatio's patents were invalid and

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<sup>42</sup> See, e.g., William J. Murphy, John L. Orcutt, & Paul C. Remus, PATENT VALUATION: IMPROVING DECISION MAKING THROUGH ANALYSIS, 292 (2012).

<sup>43</sup> *Fromson v. Western Litho Plate & Supply Co.*, 853 F.2d 1568, 1575 (Fed. Cir. 1988) (“The [hypothetical negotiation] methodology encompasses . . . flexibility because it speaks of negotiations as of the time infringement began, yet permits and often requires a court to look to events and facts that occurred thereafter and that could not have been known to or predicted by the hypothesized negotiators.”). See also *Sinclair Refining Co. v. Jenkins Petroleum Process Co.*, 289 U.S. 689, 697-99 (1933) (discussing the “book of wisdom” concept).

<sup>44</sup> The bargaining position of the parties is accounted for in several of the *Georgia-Pacific* factors. See *Georgia-Pacific*, 318 F.Supp. at 1120.

<sup>45</sup> *Innovatio*, 2013 U.S. Dist. LEXIS 144061, at \*38.

<sup>46</sup> *Id.*

that the manufacturers' products along with any networks or systems incorporating those products did not infringe Innovatio's patents.<sup>47</sup> Innovatio countered that these manufacturers also infringed the same patents and claims that had been asserted against the wireless network users.<sup>48</sup> All of these cases were transferred for pretrial coordination to Judge Holderman.<sup>49</sup>

Following discovery, the parties and the court agreed that the best way to resolve this dispute would be to pause and evaluate the potential damages available to Innovatio if all of the wireless network users and manufacturers were found to infringe Innovatio's patents.<sup>50</sup> The parties also agreed that four of Innovatio's patents did need not be considered as part of this proceeding<sup>51</sup> and the appropriate date for the hypothetical negotiation was 1997 because that was when the relevant Wi-Fi (802.11) standard was initially adopted.<sup>52</sup>

In order to evaluate the potential damages available to Innovatio, Judge Holderman relied on the Top-Down Approach.<sup>53</sup> This methodology, as applied in *Innovatio*, involved estimating the average price of a Wi-Fi chip, estimating the average profit margin on those Wi-Fi chips, estimating the relative intellectual value of Innovatio's patents, and multiplying all of those values together to obtain an approximation of the reasonable royalty rate.<sup>54</sup> Together, the first two steps allowed Judge Holderman to calculate the projected profit. Relying on a report that "calculated or projected the average selling price of a Wi-Fi chip in each year from 2000 to 2015," Judge

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<sup>47</sup> *Id.* at \*39.

<sup>48</sup> *Id.*

<sup>49</sup> *Id.*

<sup>50</sup> *Id.* at \*39-40.

<sup>51</sup> *Id.* at \*43 n.2.

<sup>52</sup> *Id.* at \*60.

<sup>53</sup> *Id.* at \*162-83.

<sup>54</sup> *Id.* at \*163-64.

Holderman determined the average price of a Wi-Fi chip was \$14.85 by assuming the price remained the same from 1997 to 2000 and averaging all of these annual projections from 1997 to 2015.<sup>55</sup> Next, based in large part on the operating profit for Broadcom's sales of Wi-Fi chips from 2000 to 2012, Judge Holderman found that the applicable profit margin was 12.1%.<sup>56</sup>

Finally, Judge Holderman calculated the relative intellectual value of Innovatio's patents by relying on the assertion that "the top 10% of all electronics patents account for 84% of the value in all electronics patents"<sup>57</sup> and estimating that the total number of Wi-Fi standard essential patents was 3,000 based on a third party report.<sup>58</sup> Earlier in the opinion, Judge Holderman concluded that all of Innovatio's patents are "of moderate to moderate-high importance to the standard" by examining the benefits of Innovatio's patented technology and the availability of alternatives in 1997.<sup>59</sup> From this, Judge Holderman concluded that "Innovatio's patents are in the top 10% of all 802.11 standard-essential patents" because (1) "any patents providing significant value are likely

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<sup>55</sup> *Id.* at \*170-76. Judge Holderman refused to use a weighted average that accounted for the number of Wi-Fi chips sold because "the hypothetical negotiation must take place in the *ex ante* world, before the patents were incorporated into the standard and without taking into account the success of the standard." *Id.* at 172. "The parties would, however, have been aware of the 1997 price of a Wi-Fi chip, and would also have been able to hypothesize that the price of that chip would probably drop over time." *Id.* at 174.

<sup>56</sup> *Id.* at \*176-77.

<sup>57</sup> *Id.* at \*181 (citing Schankerman, *supra* note 4, at 94 tbl.5 & n.12).

<sup>58</sup> *Id.* at \*177-80.

<sup>59</sup> *Id.* at \*181. The parties divided Innovatio's patents into four families, three of which were analyzed. *Id.* at \*107. For the first family, Judge Holderman found that "although some of the proposed alternatives could provide some of the functionality of the patented features, none of them would provide all of the flexibility and functionality that the 802.11 standard has with the features of Innovatio's Channel Sharing family incorporated." *Id.* at \*120. Therefore, "the Channel Sharing family is of moderate to high importance to the 802.11 standard." *Id.* For the second family, Judge Holderman found that they teach an effective way to use multiple transceivers in a wireless network, which "provides many benefits including increasing the throughput of the system." *Id.* at \*128. However, "other means of increasing throughput provide some of the benefits of the Multi-Transceiver patents and therefore diminish their importance slightly." *Id.* Therefore "the Multi-Transceiver family patents are of moderate to high importance to the 802.11 standard." *Id.* at \*129. For the last family, Judge Holderman found that "[a]lthough sleep mode operation is optional, it is significant to battery-operated devices that must conserve power," *Id.* at \*138, and "[t]here were no available alternatives at the time of standardization that would have provided all of the functionality of Innovatio's [Sleep Family] patents." *Id.* at \*138-39. However, since "Innovatio's patents are not sufficient in themselves to cover all of the features of 802.11 sleep mode," they "are of moderate importance to the standard." *Id.* at \*139.

among the top 10% of all patents essential to the 802.11 standard” and (2) “a large percentage of the 3000 standard-essential patents . . . have not had their essentiality confirmed.”<sup>60</sup> Based on these estimations and assumptions, Judge Holderman calculated that a reasonable royalty rate was 9.56 cents per chip.<sup>61</sup> His calculations can be summarized as follows:

$$\text{Royalty Rate} = \left( \$14.85 \times \frac{12.1\%}{100} \right) \times \left( \frac{84\%}{100} \times \frac{19}{3,000 \times \frac{10\%}{100}} \right) = \$0.0956$$

Overall, this is a very thoughtful and intellectually rigorous approach to calculating a reasonable royalty. However, there are a few aspects of Judge Holderman’s application of the Top-Down Approach that can be improved upon. First, despite having held that the infringer’s expected profit is not the cap for a reasonable royalty,<sup>62</sup> the Federal Circuit has also said that it is implicit in the hypothetical negotiation that the infringer make a reasonable profit.<sup>63</sup> Judge Holderman’s

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<sup>60</sup> *Id.* at \*182.

<sup>61</sup> *Id.* at \*183.

<sup>62</sup> *Douglas Dynamics, LLC v. Buyers Prods. Co.*, 717 F.3d 1336 (Fed. Cir. 2013) (citations omitted) (“This court has held that an infringer’s net profit margin is not the ceiling by which a reasonable royalty is capped.”); *Powell v. Home Depot U.S.A., Inc.*, 663 F.3d 1221 (Fed. Cir. 2011) (citations omitted); *Golight, Inc. v. Wal-Mart Stores, Inc.*, 355 F.3d 1327, 1338 (Fed. Cir. 2004) (citations omitted); *State Industries, Inc. v. Mor-Flo Industries, Inc.*, 883 F.2d 1573, 1580 (Fed. Cir. 1989) (citations omitted).

<sup>63</sup> *Hanson v. Alpine Valley Ski Area, Inc.*, 718 F.2d 1075, 1081 (Fed. Cir. 1983) (citations omitted) (internal quotation marks omitted) (“That a reasonable royalty would leave an infringer with a reasonable profit . . . is implicit. . . .”). *See also* *Applied Med. Res. Corp. v. United States Surgical Corp.*, 435 F.3d 1356, 1361 (Fed. Cir. 2006) (citations omitted); *Trans-World Mfg. Corp. v. Al Nyman & Sons, Inc.*, 750 F.2d 1552, 1568 (Fed. Cir. 1984) (alteration in original) (citations omitted) (“A reasonable royalty is the amount that ‘a person, desiring to manufacture [, use, or] sell a patented article, as a business proposition, would be willing to pay as a royalty and yet be able to make [, use, or] sell the patented article, in the market, at a reasonable profit.’”); *Wang Lab. v. Toshiba Corp.*, 993 F.2d 858, 870 (Fed. Cir. 1993) (citations omitted); *Lindemann Maschinenfabrik GmbH v. American Hoist & Derrick Co., Harris Press & Shear Div.*, 895 F.2d 1403, 1408 (Fed. Cir. 1990) (citations omitted). When affirming a lower court’s determination of a reasonable royalty, the Federal Circuit has also noted the fact that it left the infringer with a reasonable profit. *See, e.g.*, *Fuji Photo Film Co. v. Jazz Photo Corp.*, 394 F.3d 1368, 1378 (Fed. Cir. 2005).

calculations do not reserve any of the operating profit for the infringer.<sup>64</sup> Instead, all of the operating profit was divided amongst the Wi-Fi standard essential patent holders.<sup>65</sup>

Second, Mark Schankerman's economic study, which Judge Holderman relied on for the assertion that "the top 10% of all electronics patents account for 84% of the value in all electronics patents,"<sup>66</sup> was published in 1998 and it examined data covering "all patent applications in *France* for the period 1969-1982 and patent renewals for 1970-1987."<sup>67</sup> Presumably, newer data based on patents filed in the United States would be more relevant.<sup>68</sup>

Lastly, Judge Holderman's conclusion that "Innovatio's patents are in the top 10% of all 802.11 standard-essential patents" is somewhat subjective.<sup>69</sup> He provided two justifications for this conclusion: (1) Innovatio's patents are "of moderate to moderate-high importance" and "any patents providing significant value are likely among the top 10% of all patents essential to the 802.11 standard" and (2) "a large percentage of the 3000 standard-essential patents are less valuable to the standard than Innovatio's patents because they have not had their essentiality confirmed."<sup>70</sup> Neither of these justifications make it clear why Innovatio's patents were in the top 10% as opposed to the top 20% of all 802.11 standard-essential patents.

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<sup>64</sup> Judge Holderman seemed to acknowledge this concern when he observed that "the existing profit margin on chips is the likely ceiling on Innovatio's RAND royalty," *Innovatio*, 2013 U.S. Dist. LEXIS 144061, at \*167, because "chipmakers would lobby for alternative technologies to be adopted into the standard, or would leave the chip-making business altogether, rather than pay a royalty that would obliterate their profits." *Id.* at \*165-66.

<sup>65</sup> *See generally id.* at 181-82.

<sup>66</sup> *Id.* at \*181 (citing Schankerman, *supra* note 4, at 94 tbl.5 & n.12).

<sup>67</sup> Schankerman, *supra* note 4, at 80 (emphasis added).

<sup>68</sup> Recent studies have been conducted using patent renewal data from the U.S. Patent & Trademark Office. *See, e.g.,* Carlos J. Serrano, *The dynamics of the transfer and renewal of patents*, 41 RAND J. ECON. 686 (2010), available at <http://www.jstor.org/stable/25746050>; Kimberly A. Moore, *Worthless Patents*, 20 BERKELEY TECH. L.J. 1521 (2005); Barney, *supra* note 21.

<sup>69</sup> *See Innovatio*, 2013 U.S. Dist. LEXIS 144061, at \*182.

<sup>70</sup> *Id.* at \*181-82.

#### IV. The Modified Top-Down Approach

To address the concerns highlighted above, this paper proposes the following methodology for calculating a reasonable royalty rate: (1) estimate the projected operating profit generated by the smallest salable patent-practicing unit, (2) define the set of applicable patents, (3) estimate the percentage of applicable patents with a value less than or equal to the value of the patent in suit based on a set of objective indicators, (4) estimate the percentage of value held by the patent in suit using a variation of the patent renewal model initially proposed by Mark Schankerman and Ariel Pakes, (5) calculate the initial reasonable royalty rate using these estimates, and (6) adjust that rate as needed by examining the facts of the case. This methodology (the “Modified Top-Down Approach”) will inherently allocate some profit to the infringer and it will use objective indicators of value to determine the applicable percentile range for the patent in suit.

Since examples are often helpful in understanding a theory, I will apply the Modified Top-Down Approach to a hypothetical lawsuit. The patent asserted in this lawsuit is U.S. Patent No. 5,996,127 (“the ‘127 Patent”), which is entitled “Wearable Device for Feeding and Observing Birds and Other Flying Animals.”<sup>71</sup> Claim 1 of the ‘127 Patent is as follows:

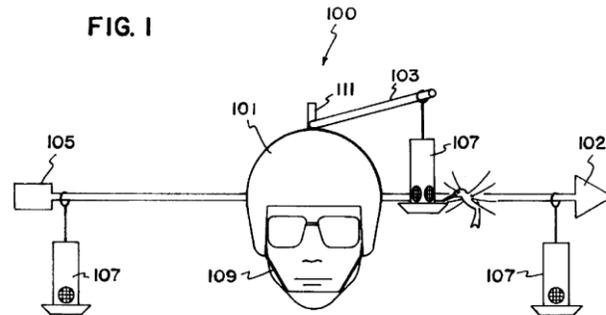
A device for feeding and observing flying animals comprising:  
a hat, the hat including a front portion and a rear portion;  
a first support mounted on the hat and extending forward of the front portion of the hat; and  
a feeder configured to contain food for flying animals mounted on the first support, wherein the flying animals can be observed while they feed.<sup>72</sup>

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<sup>71</sup> I have chosen this patent because the invention is simple, easy to understand, and might provide some amusement to my reader. I was first made aware of this patent during my freshman year of undergrad at Bucknell University by John Calvert, then an administrator at the U.S. Patent & Trademark Office, when he came to speak. He said then, and still holds, that U.S. Patent No. 5,996,127 (filed Jun. 19, 1998) is one of the most “interesting” patents that he has come across. See John Calvert, *The Patents of My Career*, INVENTORS EYE (June 2014), <http://www.uspto.gov/custom-page/inventors-eye-1>. Technically, this patent expired on December 7, 2011, but this fact will be ignored for the purposes of this paper. See *Patent Maintenance Fees*, U.S. PATENT & TRADEMARK OFFICE, <https://ramps.uspto.gov/eram/patentMaintFees.do> (last visited Mar. 26, 2015).

<sup>72</sup> ‘127 Patent, col. 5 ll. 27-34.

An actual prototype of the invention described in '127 Patent is shown below alongside Figure 1 from the '127 Patent.<sup>73</sup>



The allegedly infringing product is the “Hummingbird Hat,” which is sold by Roy Road Fish Company on Etsy.<sup>74</sup> Images of this product are shown below.<sup>75</sup>



In each step that follows, a portion of the Modified Top-Down Approach will be explained generally and then applied to the hypothetical lawsuit.

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<sup>73</sup> The image on the left depicts the inventor of the '127 Patent, David Leslie, wearing a prototype of his invention. Steve Alexander, *Obituary: Stockbroker David Leslie's love of nature led him to invent Hummer Helmet*, STAR TRIBUNE (Feb. 25, 2013), <http://www.startribune.com/local/minneapolis/193175831.html>. For those that are curious, there are several videos online of this invention in action. See, e.g., *The Hummer Helmet*, ANIMAL PLANET, <http://www.animalplanet.com/tv-shows/other/videos/amazing-animal-videos-the-hummer-helmet/> (last visited Mar. 30, 2015); *HummerHelmet, 2005 Hummer Helmet Video*, YOUTUBE (Nov 14, 2008), <https://www.youtube.com/watch?v=waqrk4jFFU>. The YouTube video also includes a brief clip from when David Leslie appeared on the Late Show with David Letterman to talk about his invention.

<sup>74</sup> *Hummingbird Feeder Hat, Red White & Blue*, ETSY, [https://www.etsy.com/listing/173169030/hummingbird-feeder-hat-red-white-blue?ref=shop\\_home\\_active\\_2](https://www.etsy.com/listing/173169030/hummingbird-feeder-hat-red-white-blue?ref=shop_home_active_2) (last visited Mar. 30, 2015).

<sup>75</sup> *Id.*

**A. Estimate the projected operating profit generated by the smallest salable patent-practicing unit.**

The goal of this step is to obtain a baseline for calculating a reasonable royalty rate by estimating the profit generated by the “smallest salable patent-practicing unit.”<sup>76</sup> Defining the smallest salable patent-practicing unit can be a complex task, but one that is familiar to patent attorneys and courts. For example, in *Innovatio*, the patent holder argued that “the court should calculate the royalty as a percentage of the selling price of end-products with wireless functionality, including laptops, tablet computers, printers, access points, and the like.”<sup>77</sup> The defendants countered that “*Innovatio*'s patents did not invent access points, radios, or antennas, but instead only a method for using those devices, the instructions for which are contained on the Wi-Fi chip.”<sup>78</sup> Therefore, “the smallest salable patent-practicing unit [wa]s the Wi-Fi chip.”<sup>79</sup> Judge Holderman agreed that using the “end-products as a royalty base would include value far beyond the patented features of the 802.11 standard that *Innovatio*'s patents do protect.”<sup>80</sup> He ultimately decided to calculate a reasonable royalty based on the Wi-Fi chip because *Innovatio* “did not credibly apportion the value of the end-products down to the patented features.”<sup>81</sup>

With regard to estimating the profit generated, a court is free to use whatever profit accounting method that it deems appropriate.<sup>82</sup> However, the special master in *TWM* implicitly

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<sup>76</sup> See *VirnetX, Inc. v. Cisco Systems, Inc.*, 767 F.3d 1308, 1327-28 (Fed. Cir. 2014); *LaserDynamics, Inc. v. Quanta Computer, Inc.*, 694 F.3d 51, 67 (Fed. Cir. 2012).

<sup>77</sup> *Innovatio*, 2013 U.S. Dist. LEXIS 144061, at \*73-74.

<sup>78</sup> *Id.* at \*80.

<sup>79</sup> *Id.*

<sup>80</sup> *Id.* at \*82.

<sup>81</sup> *Id.*

<sup>82</sup> *Mars, Inc. v. Coin Acceptors, Inc.*, 527 F.3d 1359, 1374 (Fed. Cir. 2008) (“We have never held that any one profit accounting methodology is appropriate in all industries, for all companies, in all cases. The selection of the appropriate method of profit accounting in the circumstances is properly left to the broad discretion of the district court.”). See also *Rite-Hite Corp. v. Kelley Co.*, 56 F.3d 1538 (Fed. Cir. 1995) (emphasis added) (citing *State Industries, Inc. v.*

relied on *operating profit* when implementing the analytical approach,<sup>83</sup> Judge Holderman looked at Broadcom’s *operating profit* when implementing the Top-Down Approach,<sup>84</sup> and the main proponents of the 25 percent rule of thumb advocated for the use of *operating profit* instead of net profit because the “value of intellectual property is independent of the way in which a firm (or project) is financed.”<sup>85</sup> Therefore, it would seem that operating profit provides the best baseline for determining the value of patents.

Turning to the hypothetical lawsuit, Claim 1 of the ‘127 Patent is directed at the entire end-product.<sup>86</sup> Therefore, the smallest salable patent-practicing unit is the “Hummingbird Hat.” During the hypothetical discovery, I will pretend that I found out that (1) the cost of the materials to make a single “Hummingbird Helmet” is \$20, (2) the cost of the labor is \$10, (3) the cost of creating the promotional video<sup>87</sup> divided by the number of sales of the “Hummingbird Helmet” is \$3, and (4) the cost of listing the item on Etsy is \$0.20.<sup>88</sup> Furthermore, the “Hummingbird Hat” is sold by Roy Road Fish Company on Etsy for \$42.00.<sup>89</sup> Therefore, the operating profit generated by a single “Hummingbird Hat” is \$8.80.

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Mor-Flo Industries, Inc., 883 F.2d 1573, 1580 (Fed. Cir. 1989); *Stickle v. Heublein, Inc.*, 716 F.2d 1550, 1563 (Fed. Cir. 1983)) (“It was [] not unreasonable for the district court to find that an unwilling patentee would only license for one-half its expected lost profits and that such an amount was a reasonable royalty. The fact that the award was not based on the *infringer’s profits* did not make it an unreasonable award.”).

<sup>83</sup> See *supra* note 36.

<sup>84</sup> *Innovatio*, 2013 U.S. Dist. LEXIS 144061, at \*176-77.

<sup>85</sup> *Goldscheider et al.*, *supra* note 22, at 125.

<sup>86</sup> ‘127 Patent, col. 5 ll. 27-34.

<sup>87</sup> There is a YouTube video of this device in action. Royroadfishcompany, *Roy Road Fish Company “Hummingbird Hat”*, YOUTUBE (June 20, 2009), <https://www.youtube.com/watch?v=oZ24oBaO56w>.

<sup>88</sup> Aside from the listing price on Etsy, all of these numbers are completely made up. See *Fees Policy*, ETSY (Mar. 11, 2015), <https://www.etsy.com/help/article/2144>.

<sup>89</sup> *Hummingbird Feeder Hat, Red White & Blue*, ETSY, [https://www.etsy.com/listing/173169030/hummingbird-feeder-hat-red-white-blue?ref=shop\\_home\\_active\\_2](https://www.etsy.com/listing/173169030/hummingbird-feeder-hat-red-white-blue?ref=shop_home_active_2) (last visited Mar. 30, 2015).

## **B. Define the set of applicable patents.**

The “set of applicable patents” is a set of patents that might cover the smallest salable patent-practicing unit identified in the previous step. The Modified Top-Down Approach is primarily designed to address situations where there are so many patents that might cover an allegedly infringing product or process that it is impracticable to determine the relative value of each of those patents. If one is presented with a situation where there are only a few applicable patents, there is no need to resort to statistics. Furthermore, this paper does not advocate for a purely objective approach to calculating a reasonable royalty based on statistics. Instead, these statistics are merely used to produce an objective starting point that should then be adjusted according to the specific facts of the case.

In *Innovatio*, Judge Holderman referred to a third party report to estimate the number of Wi-Fi standard essential patents.<sup>90</sup> However, in many cases such reports are not going to exist. Since the goal here is merely to obtain a reasonable and objective estimate, the set of applicable patents can be somewhat narrowly defined using a patent classification system<sup>91</sup> in combination with keyword searching. Specifically, these tools can be used to generate a list of “potentially applicable patents.” Depending on the size of that list, there are at least two ways to proceed. If the list is small enough, then a person can manually go through it and remove all patents that are clearly irrelevant to the infringing product or process. The remaining patents would be considered the set of applicable patents. If the list of potentially applicable patents is large, then a sample of

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<sup>90</sup> *Innovatio*, 2013 U.S. Dist. LEXIS 144061, at \*177-80.

<sup>91</sup> *Classification Standards and Development*, U.S. PATENT & TRADEMARK OFFICE, <http://www.uspto.gov/patents-application-process/patent-search/classification-standards-and-development> (last visited Mar. 22, 2015).

those patents can be evaluated in order to estimate the percentage of those patents that would be included in the set of applicable patents.

An infringing party that wishes to use the Modified Top-Down Approach should not be worried about admitting to additional infringement by defining the set of applicable patents. First, the review of the potentially relevant patents or a sample of those patents should be cursory. Second, if only a sample of the potentially relevant patents is reviewed, then there is no precise list of applicable patents. Third, with regard to the third party report, Judge Holderman observed that “there is no guarantee that all of those approximately 3000 potentially essential patents are in fact essential.”<sup>92</sup> The significance of this fact was that Innovatio’s confirmed standard essential patents were “more valuable to the 802.11 standard than many of the potentially essential patents.”<sup>93</sup> This is the proper way to understand the situation and it is something that can be accounted for in the final step of the Modified Top-Down Approach.

For the hypothetical lawsuit, I defined the set of applicable patents by first identifying all of the potentially relevant U.S. classifications. I started by looking at how the ‘127 Patent is classified. The ‘127 Patent, under the U.S. classification system, is primarily classified under class 2/422.<sup>94</sup> It is also classified under classes 2/410, 2/209.13, 119/715 and 446/27.<sup>95</sup> Next, I examined (1) how the patents cited during prosecution of the ‘127 Patent are primarily classified<sup>96</sup> and (2)

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<sup>92</sup> *Innovatio*, 2013 U.S. Dist. LEXIS 144061, at \*179.

<sup>93</sup> *Id.* at \*180.

<sup>94</sup> ‘127 Patent, cover page.

<sup>95</sup> *Id.*

<sup>96</sup> The following patents were cited during the prosecution of the ‘127 Patent: U.S. Patent No. 3,813,016 (filed Feb. 9, 1973) (primarily under class 224/162), U.S. Patent No. 4,079,940 (filed Sep. 13, 1976) (primarily under class 473/210), U.S. Patent No. 4,268,918 (filed Apr. 25, 1980) (primarily under class 2/172), U.S. Patent No. 4,675,916 (filed Mar. 7, 1986) (primarily under class 2/181), U.S. Patent No. 4,760,610 (filed Sep. 24, 1987) (primarily under class 2/209.13), U.S. Patent No. 4,905,406 (filed Mar. 8, 1989) (primarily under class 43/107), U.S. Patent No. 5,107,796 (filed July 17, 1991) (primarily under class 119/72), U.S. Patent No. 5,181,139 (filed Nov. 4, 1991) (primarily under class 359/408), U.S. Patent No. 5,226,180 (filed Dec. 2, 1991) (primarily under class 2/411), U.S.

how the patents referencing the ‘127 Patent are primarily classified.<sup>97</sup> If these classifications are included, the list of potentially relevant classes includes: 2/6.7, 2/172, 2/175.7, 2/181, 2/209.13, 2/410, 2/411, 2/422, 2/425, 43/107, 119/51.01, 119/57.8, 119/72, 119/537, 119/715, 224/162, 351/155, 359/408, 446/27, and 473/210. I also performed a quick prior art search and was only able to find one other patent describing a wearable bird feeder, U.S. Patent No. 8,539,910 (the ‘910 Patent). The ‘910 Patent cites the ‘127 Patent, so its primary, and only, classification had already been accounted for.<sup>98</sup>

Next, I reviewed some of the patents covered by these classes and subclasses and determined whether there were any keywords I could use to narrow down the list of patents covered by these classes and subclasses. In the end, I decided to be over-inclusive rather than under-inclusive. Based on the names of the various inventions listed under the relevant apparel subclasses (*i.e.*, Class 2),<sup>99</sup> I felt that I would not be able to account for all of the ways inventions reference

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Patent No. 5,530,970 (filed Aug. 1, 1994) (primarily under class 2/209.13), U.S. Patent No. 5,675,841 (filed Apr. 24, 1995) (primarily under class 2/175.7), U.S. Patent Des. No. 287,061 (filed Feb. 18, 1986) (design patent primarily under class D2/866), and U.S. Patent Des. No. 341,911 (filed Mar. 23, 1992) (design patent primarily under class D30/133). See *USPTO Patent Full-Text and Image Database*, U.S. PATENT & TRADEMARK OFFICE, <http://patft.uspto.gov/netahhtml/PTO/search-adv.htm> (last visited Mar. 26, 2015).

<sup>97</sup> As of March 26, 2015, the following patents have cited the ‘127 Patent: U.S. Patent No. 6,374,407 (filed May 31, 2000) (primarily under class 2/6.7), U.S. Patent No. 6,450,126 (filed Nov. 3, 2000) (primarily under class 119/537), U.S. Patent No. 6,564,394 (filed Oct. 9, 2001) (primarily under class 2/410), U.S. Patent No. 6,595,635 (filed Oct. 12, 2001) (primarily under class 351/155), U.S. Patent No. 6,817,711 (filed May 20, 2003) (primarily under class 351/155), U.S. Patent No. 6,837,178 (filed Feb. 11, 2003) (primarily under class 119/57.8), U.S. Patent No. 7,124,706 (filed June 30, 2003) (primarily under class 119/51.01), U.S. Patent No. 7,398,562 (filed Mar. 10, 2004) (primarily under class 2/425), U.S. Patent No. 7,461,408 (filed Oct. 7, 2005) (primarily under class 2/209.13), U.S. Patent No. 8,458,821 (filed Dec. 11, 2008) (primarily under class 2/422), U.S. Patent No. 8,539,910 (filed Nov. 8, 2010) (primarily under class 119/72), and U.S. Patent No. 8,739,319 (filed May 7, 2013) (primarily under class 2/422). See *USPTO Patent Full-Text and Image Database*, *supra* note 96.

<sup>98</sup> ‘910 Patent, cover page.

<sup>99</sup> See *Class 2: Apparel*, U.S. PATENT & TRADEMARK OFFICE, <http://www.uspto.gov/web/patents/classification/uspc002/sched002.htm> (last visited Mar. 28, 2015). See also *USPTO Patent-Full-Text and Image Database*, *supra* note 96.

head gear.<sup>100</sup> However, classes 43/107, 119/51.01, and 119/72 refer to devices for animals more generally. Therefore, I decided to narrow those search results by including the keyword “bird.” I also decided to remove classes 224/162, 359/408, and 473/210 because the inventions included seemed to be almost entirely irrelevant to the allegedly infringing product. For example, a query for all patents classified under 473/210 mostly produced inventions for improving your golfing technique.<sup>101</sup>

After copying all of these search results into Microsoft Excel and removing the duplicates,<sup>102</sup> I was left with 2,636 utility patents.<sup>103</sup> I then reduced this number to 2,248 utility patents by removing all patents filed before 1989. Any patents filed before this date have most likely expired and can no longer be used to assert patent infringement.<sup>104</sup> Going forward, I will refer to this group of 2,248 patents as the “potentially applicable patents.” Lastly, I reviewed a random sample of 329 patents from this list and found that 11 of them should be included in the

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<sup>100</sup> I used the “CCL” field code to perform several advanced searches on the USPTO Patent-Full-Text and Image Database. *See USPTO Patent-Full-Text and Image Database, supra* note 96. In retrospect, after reviewing the potentially relevant patents in more detail, I could have limited the Class 2 patents to those containing the keyword “helmet.”

<sup>101</sup> *See USPTO Patent-Full-Text and Image Database, supra* note 96.

<sup>102</sup> This is a function built right into Microsoft Excel. *See Filter for Unique Values or Remove Duplicate Values*, MICROSOFT, <https://support.office.com/en-in/article/Filter-for-unique-values-or-remove-duplicate-values-d6549cf0-357a-4acf-9df5-ca507915b704> (last visited Mar. 28, 2015).

<sup>103</sup> I included reissue patents, but I chose to ignore design patents and statutory invention registrations. In comparison to utility patents, design patents have a narrow scope and are much less likely to cover the allegedly infringing product. *See generally* M.P.E.P. § 1502.01 (9th ed., 11th rev. 2013). A statutory invention registration is “prior art,” but it does not allow the owner to “exclude others from making, using, selling, offering to sell, or importing the invention.” M.P.E.P. § 1111 (9th ed., 11th rev. 2013).

<sup>104</sup> *See* 35 U.S.C. § 154(a)(2) (2012) (stating the general rule that the term of a patent is “20 years from the date on which the application for the patent was filed”); 35 U.S.C. § 286 para. 1 (2012) (stating that “no recovery shall be had for any infringement committed more than six years prior to the filing of the complaint or counterclaim for infringement”).

set of applicable patents.<sup>105</sup> Therefore, the total number of applicable patents is 75. In making this determination, I only looked at the first page of each patent in the random sample. Based on the picture and the abstract, I tried to gauge the scope of the patent and determine whether it might cover the “Hummingbird Hat.” The patents that remained mostly related to bicycle helmets and tubular bird feeders.<sup>106</sup>

**C. Estimate the percentage of applicable patents with a value less than or equal to the value of the patent in suit based on a set of objective indicators.**

The goal of this step is to estimate the percentage of applicable patents with a value less than or equal to the value of the patent in suit based on a set of objective indicators. If there are multiple patents asserted in a lawsuit, then these calculations should be performed on each of those patents individually. Also, if there is not a precise list of applicable patents, then the set of potentially applicable patents can be used. Based on a literature review, some of the more promising objective indicators of value include: (1) the number of forward citations,<sup>107</sup> (2) the

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<sup>105</sup> With a population of 2,248, a sample of 329 patents is required for a 95% confidence level and a 5% confidence interval. See *Sample Size Calculator*, AUSTRALIAN BUREAU OF STATISTICS, <http://www.nss.gov.au/nss/home.nsf/pages/Sample+size+calculator> (last visited Mar. 28, 2015).

<sup>106</sup> The 11 patents I decided to include were U.S. Patent No. 5,099,523 (filed Jan. 25, 1991) (describing a reinforced expanded plastic helmet construction); U.S. Patent No. 5,435,268 (filed July 19, 1994) (describing a tubular plastic bird feeder); U.S. Patent No. 5,608,918 (filed Sep. 8, 1994) (describing a helmet strap stabilizer clip); U.S. Patent No. 5,642,689 (filed Aug. 7, 1995) (describing a tubular bird feeder); U.S. Patent No. 5,651,145 (filed Sep. 11, 1995) (describing a bicycle helmet); U.S. Patent No. 5,675,843 (filed Feb. 29, 1996) (describing a helmet visor attachment apparatus); U.S. Patent No. 5,813,055 (filed Nov. 7, 1997) (describing a bicycle helmet); U.S. Patent No. 6,301,718 (filed Nov. 8, 2000) (describing a general protective helmet); U.S. Patent No. 6,795,977 (filed May 21, 2001) (describing a protective helmet with a means for connection of an accessory); U.S. Patent No. 7,111,582 (filed May 28, 2004) (describing a port attachment system for bird feeders); and U.S. Patent No. 7,610,876 (filed June 6, 2008) (describing a tubular bird feeder).

<sup>107</sup> Serrano, *supra* note 68; Moore, *supra* note 68; Bronwyn H. Hall et al., *Market Value and Patent Citations*, 36 RAND J. ECON. 16 (2005), available at <http://www.jstor.org/stable/1593752>; Jean O. Lanjouw & Mark Schankerman, *Patent Quality and Research Productivity: Measuring Innovation with Multiple Indicators*, 114 ECON. J. 441 (2004) [hereinafter *Lanjouw & Schankerman (2004)*], available at <http://www.jstor.org/stable/3590103>; John R. Allison et al., *Valuable Patents*, 92 GEO. L.J. 435 (2004); Barney, *supra* note 21; Jean O. Lanjouw & Mark Schankerman, *Characteristics of Patent Litigation: A Window on Competition*, 32 RAND J. ECON. 129 (2001) [hereinafter *Lanjouw & Schankerman (2001)*], available at <http://www.jstor.org/stable/2696401>; Dietmar Harhoff et al., *Citation Frequency and the Value of Patented Inventions*, 81 REV. ECON. & STAT. 511 (1999), available at <http://www.jstor.org/stable/2646773>; Hilary Shane & Mark Klock, *The Relation between Patent Citations and Tobin's Q in*

number of backward citations,<sup>108</sup> (3) the number of related patents,<sup>109</sup> (4) the number of related classes,<sup>110</sup> (5) the number of claims,<sup>111</sup> and (6) the number of times a patent is traded.<sup>112</sup> A single model incorporating these objective indicators of value can be used to assign a value quantity to the patent in suit.<sup>113</sup> For example, in 2004, Jean Lanjouw and Mark Schankerman described a “patent quality index” that is a linear combination of the number of forward citations, backward citations, claims, and family size.<sup>114</sup> The weight assigned to each of these indicators corresponded to “the increase in the expected value of quality associated with a unit increase in that indicator.”<sup>115</sup> While the detail of this model is exemplary, any reasonable method for assigning a value quantity to a particular patent based on various objective indicators can be used.

For the hypothetical lawsuit, I took a fairly simplistic approach.<sup>116</sup> First, for each potentially applicable patent, I obtained (1) the number of U.S. classifications it fell into, (2) the number of claims in the patent, (3) the number of backward citations to U.S. patents on its face,

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*the Semiconductor Industry*, 9 REV. QUANTITATIVE FIN. & ACCT. 131 (1997), available at <http://link.springer.com/article/10.1023%2FA%3A1008208425044>; Manuel Trajtenberg, *A Penny for Your Quotes: Patent Citations and the Value of Innovations*, 21 RAND J. ECON. 172 (1990), available at <http://www.jstor.org/stable/2555502>.

<sup>108</sup> Moore, *supra* note 68; Lanjouw & Schankerman (2004), *supra* note 107; Allison et al., *supra* note 107.

<sup>109</sup> Moore, *supra* note 68; Gideon Parchomovsky & R. Polk Wagner, *Patent Portfolios*, 154 U. PA. L. REV. 1 (2005); Lanjouw & Schankerman (2004), *supra* note 107; Barney, *supra* note 21.

<sup>110</sup> Serrano, *supra* note 68; Bronwyn H. Hall et al., *The NBER Patent Citation Data File: Lessons, Insights and Methodological Tools* (Nat'l Bureau of Econ. Research, Working Paper No. 8498, 2001), available at <http://www.nber.org/papers/w8498>; Joshua Lerner, *The Importance of Patent Scope: An Empirical Analysis*, 25 RAND J. ECON. 319 (1994), available at <http://www.jstor.org/stable/2555833>.

<sup>111</sup> Moore, *supra* note 68; Lanjouw & Schankerman (2004), *supra* note 107; Allison et al., *supra* note 107; Barney, *supra* note 21.

<sup>112</sup> Serrano, *supra* note 68.

<sup>113</sup> See, e.g., Lanjouw & Schankerman (2004), *supra* note 107; Barney, *supra* note 21.

<sup>114</sup> Lanjouw & Schankerman (2004), *supra* note 107, at 446-52.

<sup>115</sup> *Id.* at 451.

<sup>116</sup> I do not think that this approach is better than the one employed by Jean Lanjouw and Mark Schankerman in 2004, but I do think it is easier to understand and apply. There may be sources describing a similar approach, but I developed it independently for this paper.

and (4) the number of times it had been cited by another U.S. patent (i.e., forward citations).<sup>117</sup> Next, I copied that raw data into Microsoft Excel and for each indicator of each patent, I calculated the percentage of patents associated with a particular indicator value less than or equal to the particular indicator value of that patent.<sup>118</sup> For example, if a patent had 17 claims, I determined the percentage of patents with 17 or less claims. Next, I averaged the four resulting percentages to obtain a value index. Lastly, for each patent, I calculated the percentage of patents with a value index less than or equal to the value index of that particular patent. Ultimately, I found that the ‘127 Patent has a value index greater than or equal to the value index of 91.55% of the 2,248 potentially applicable patents.

#### **D. Estimate the percentage of value held by the patent in suit.**

The goal of this step is to approximate the percentage of the projected operating profit that should be assigned to the patent in suit. Several economic studies have used patent renewal data to approximate the value of patents.<sup>119</sup> This concept was originally developed by Mark

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<sup>117</sup> I obtained this information directly from the USPTO Patent-Full-Text and Image Database using a screen scraping program that I wrote in AutoIt, “a freeware BASIC-like scripting language designed for automating the Windows GUI and general scripting.” *AutoIt: Automation and Scripting Language*, AUTOIT, <https://www.autoitscript.com/site/autoit/> (last visited Mar. 30, 2015).

<sup>118</sup> For example, for the claim count indicator, I used following formula: “=(COUNTA(\$F\$2:\$F\$21) - RANK.EQ(F2, \$F\$2:\$F\$21) + 1) / COUNTA(\$F\$2:\$F\$21),” where \$F\$2:\$F\$21 defined the column containing all of the claim counts and F2 was the particular claim count being evaluated.

<sup>119</sup> See, .e.g., Serrano, *supra* note 68; Moore, *supra* note 68; Barney, *supra* note 21; Jean O. Lanjouw et al., *How to Count Patents and Value Intellectual Property: The Uses of Patent Renewal and Application Data*, 46 J. INDUS. ECON. 405 (1998), available at <http://www.jstor.org/stable/117497>; Jean O. Lanjouw, *Patent Protection in the Shadow of Infringement: Simulation Estimations of Patent Value*, 65 REV. ECON. STUD. 671 (1998), available at <http://www.jstor.org/stable/2566908>; Schankerman, *supra* note 4; Jonathan Putnam, *The Value of International Patent Rights* (Feb. 3, 1997) (unpublished Ph.D. dissertation, Yale University), available at <http://www.competitiondynamics.com/basics/who-is-cd>; Richard J. Sullivan, *Estimates of the Value of Patent Rights in Great Britain and Ireland, 1852-1876*, 61 ECONOMICA 37 (Feb., 1994), available at <http://www.jstor.org/stable/2555048>; Ariel Pakes & Margaret Simpson, *Patent Renewal Data*, BROOKINGS PAPERS ON ECON. ACTIVITY, 1989, at 331, available at <http://www.jstor.org/stable/2534724>; Mark Schankerman & Ariel Pakes, *Estimates of the Value of Patent Rights in European Countries During the Post-1950 Period*, 96 ECON. J. 1052 (1986), available at <http://www.jstor.org/stable/2233173>; Ariel Pakes, *Patents as Options: Some Estimates of the Value of Holding European*

Schankerman and Ariel Pakes in 1984.<sup>120</sup> In the United States, all utility patents are subject to maintenance (*i.e.*, renewal) fees, which must be paid to keep the patent in force.”<sup>121</sup> These maintenance fees are due at the following times: (1) three to three and a half years after the utility patent issued; (2) seven to seven and a half years after the utility patent issued; and (3) eleven to eleven and a half years after the utility patent issued.<sup>122</sup> Late payments made within six months of one of these deadlines are accepted with a surcharge.<sup>123</sup> Currently, these fees are \$1,600, \$3,600, and \$7,400 respectively with discounts available for small and micro entities.<sup>124</sup>

A fundamental assumption underlying the concept of using patent renewal data to approximate patent value is that “patentees make a profit-maximizing renewal decision,”<sup>125</sup> In other words, a patent owner will continue to pay the maintenance fees as long as the expected future revenue generated by the patent exceeds the maintenance fees. In 1984, Mark Schankerman and Ariel Pakes mathematically described the value of a patent as follows:

$$V(T) = \int_0^T [r(t) - c(t)]e^{-it} dt, \quad (1)$$

where  $V(T)$  is the discounted value of the revenue generated by the patent over its life span  $T$ ,  $r(t)$  is the revenue generated by the patent in year  $t$ ,  $c(t)$  is the renewal fee in year  $t$ , and  $i$  is the discount

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*Patent Stocks*, 54 *ECONOMETRICA* 755 (1986), available at <http://www.jstor.org/stable/1912835>; Pakes & Schankerman, *supra* note 5.

<sup>120</sup> Pakes & Schankerman, *supra* note 5.

<sup>121</sup> *Maintain Your Patent*, U.S. PATENT & TRADEMARK OFFICE, <http://www.uspto.gov/patents-maintaining-patent/maintain-your-patent#> (last visited Feb. 28, 2015). See also 37 C.F.R. § 1.362.

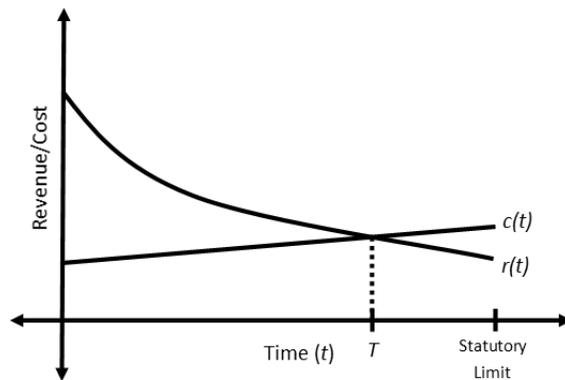
<sup>122</sup> *Id.*

<sup>123</sup> *Id.*

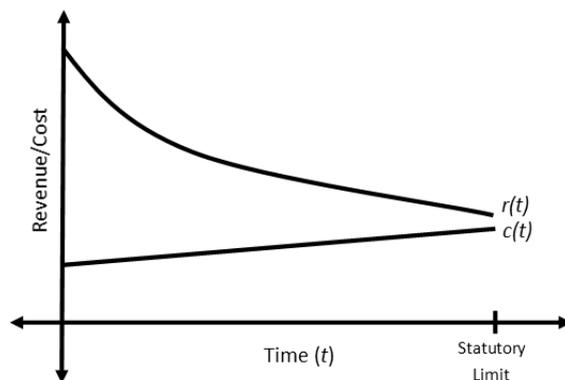
<sup>124</sup> *Current Fee Schedule*, U.S. PATENT & TRADEMARK OFFICE, <http://www.uspto.gov/learning-and-resources/fees-and-payment/uspto-fee-schedule> (last visited Feb. 28, 2015). See also 37 C.F.R. § 1.20.

<sup>125</sup> Schankerman, *supra* note 4, at 78.

rate.<sup>126</sup> This formula captures the notion that the discounted value of a patent equals the revenue generated by that patent during its lifetime minus the costs of maintaining it. Based on the assumption just discussed, a patentee will seek to maximize  $V(T)$  by selecting the optimal life span  $T$ . For example, if one assumes that the revenue generated by a patent consistently decreases over time, then a patentee will stop paying the maintenance fees as soon as  $r(t)$  is less than  $c(t)$ . This situation can be depicted graphically as follows:



From this graphic, one can see that the patentee will start losing money on the patent after time  $T$ . However, if  $r(t)$  is always greater than  $c(t)$ , then the optimal life span  $T$  will be the statutorily permissible lifespan of the patent. This situation can be depicted graphically as follows:




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<sup>126</sup> Pakes & Schankerman, *supra* note 5, at 75.

In the United States, the lifespan of a patent is 20 years from the filing of the application plus any extensions granted by the Patent Office.<sup>127</sup>

As presented in continuous time, Equation 1 is somewhat misleading. In reality, all of the events represented by  $c(t)$  and  $r(t)$  occur at discrete times. In the United States, there is a maximum of only three points in time where a patentee can decide whether or not to pay a maintenance fee. Furthermore, the revenue generated by a patent is not continuous. Instead, license payments are made at one or more discrete times. The discrete nature of these events has given rise to some discussion in the literature about how to incorporate the concept of uncertainty into the formula discussed so far.<sup>128</sup> If one assumes that the revenue generated by a patent is completely deterministic, then a patent holder can accurately decide when a maintenance fee is due whether or not the future revenue generated by the patent will cover that maintenance fee. The problem is that this assumption significantly oversimplifies reality. At least two classes of patent renewal models have been developed to allow for uncertainty.<sup>129</sup> The details of these models go beyond the scope of this paper, but it is worth mentioning that in 1986, Ariel Pakes conducted a study where he concluded that most of the uncertainty associated with determining the future revenue generated by a patent was resolved by the fifth year of the patent's life.<sup>130</sup>

It is also important to understand some the assumptions that have been made about  $r(t)$  in economic studies. The other parts of Equation 1 are easily calculated. In the United States, the discount rate,  $i$ , is “how much the U.S. central bank charges its member banks to borrow from its

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<sup>127</sup> See generally M.P.E.P. § 2700 (9th ed., 11th rev. 2013).

<sup>128</sup> See Lanjouw, *supra* note 119; Pakes & Simpson, *supra* note 119; Pakes, *supra* note 119.

<sup>129</sup> Compare Lanjouw, *supra* note 119 (extending the parametric model described by Pakes in 1986), and Pakes, *supra* note 119 (describing a parametric model), with Pakes & Simpson, *supra* note 119 (describing a nonparametric model).

<sup>130</sup> Pakes, *supra* note 119, at 773.

discount window to maintain the reserve it requires.”<sup>131</sup> Furthermore,  $c(t)$  is simply the maintenance fee schedule provided by the U.S. Patent & Trademark Office.<sup>132</sup> However, the way that  $r(t)$  behaves is unknown and must be approximated. Several economic studies have assumed that the revenues generated by a patent decay deterministically over time.<sup>133</sup> For example, in 1984, Pakes and Schankerman assumed  $r(t)$  took the following form:

$$r(t) = R_0 e^{-\delta t}, \quad (2)$$

where  $R_0$  is the initial revenue generated by the patent and  $\delta$  is the rate of decay.<sup>134</sup> After determining that “the value of patents tends to follow a Pareto-Levy distribution” and assuming the initial revenue generated by the set of patents studied was distributed in the same way, they estimated the value of  $\delta$  to be 0.25.<sup>135</sup> Other economic studies have used stochastic models for  $r(t)$  that account for the possibility of increased revenues.<sup>136</sup>

Regardless of whether or not  $r(t)$  is approximated using a deterministic or a stochastic model, the fact remains that  $r(t)$  is a simplified approximation of the actual revenue generated by

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<sup>131</sup> Kimberly Amadeo, *Federal Reserve Discount Rate: Impact and How It Works*, ABOUT NEWS (Feb. 12, 2015), [http://useconomy.about.com/od/monetarypolicy/f/feds\\_cut\\_rate.htm](http://useconomy.about.com/od/monetarypolicy/f/feds_cut_rate.htm). See also *Current Discount Rates*, FEDERAL RESERVE, <https://www.frbdiscountwindow.org/Pages/Discount-Rates/Current-Discount-Rates.aspx> (last visited Mar. 16, 2015).

<sup>132</sup> *Current Fee Schedule*, *supra* note 124.

<sup>133</sup> See, e.g., Schankerman, *supra* note 4, at 88 (assuming the revenue generated by a patent declines deterministically according to a sequence of decay rates that are the same for all patents); Putnam, *supra* note 119, at 29-31 (following the model initially proposed by Pakes and Schankerman in 1984 and assuming the revenue generated by a patent declines deterministically); Sullivan, *supra* note 119, at 39-40 (assuming the revenue generated by a patent declines deterministically at a constant rate after the fourth year); Schankerman & Pakes, *supra* note 119, at 1054-55 (assuming the revenue generated by a patent declines deterministically according to a sequence of decay rates that are the same for all patents); Pakes & Schankerman, *supra* note 5, at 76 (assuming the revenue generated by a patent declines deterministically at a constant rate).

<sup>134</sup> Pakes & Schankerman, *supra* note 5, at 76.

<sup>135</sup> *Id.* at 76-80.

<sup>136</sup> See, e.g., Lanjouw, *supra* note 119, at 675-77; Pakes, *supra* note 119, at 764-65.

a patent over time.<sup>137</sup> Furthermore,  $c(t)$  does not actually represent all of the costs associated with maintaining a patent. For example, there are significant up-front costs associated with obtaining a patent.<sup>138</sup> There are also significant costs and potential rewards associated with litigating a patent.<sup>139</sup> Therefore, while it may be fair to assume that patent renewal data provides some insight into the actual value of a patent and that patentees make profit-maximizing renewal decisions,<sup>140</sup> the value of a patent obtained from using a patent renewal model should not be used directly when determining a reasonable royalty rate. Instead, the relative value of patents in a percentile range corresponding to the value of the patent in suit should be used to apportion the projected excess profits. Presumably, this will produce a reasonable royalty rate that is more closely connected to the actual or expected market conditions.

Turning once again to the hypothetical lawsuit, I will illustrate this concept using a slightly simplified version of the model originally described by Mark Schankerman and Ariel Pakes in 1984. First, I narrowed down the set of potentially relevant patents to those that issued before March 24, 2003. I did this to limit the set to those patents for which the owners had had the opportunity to renew the patent for the maximum length of time. Next, I collected all of the maintenance fee events for those patents.<sup>141</sup> After copying those events into Microsoft Excel and

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<sup>137</sup> See Lanjouw et al, *supra* note 119, at 408-11.

<sup>138</sup> In his thesis, Jonathan Putnam provided a method for accounting for the fixed cost of filing. Putnam, *supra* note 119, at 29-30.

<sup>139</sup> In 1998, Jean Lanjouw extend the stochastic renewal model created by Pakes in 1986 by “introducing the possibility of litigation and specifying a more flexible model of returns.” Lanjouw, *supra* note 119, at 673.

<sup>140</sup> *Contra* Christine MacLeod et al., *Evaluating Inventive Activity: The Cost of Nineteenth-Century UK Patents and the Fallibility of Renewal Data*, 56 *ECON. HIST. REV.* 537 (2003), available at <http://www.jstor.org/stable/3698574> (“Many nineteenth-century patentees lacked both sufficient information about the technical viability of their invention to make a rational choice about renewal and the financial resources to implement a positive decision. The application of Schankerman and Pakes's model to the nineteenth-century UK patent system is undermined by this failure of choice.”).

<sup>141</sup> This information is contained in one text file that is periodically updated and available for download on the U.S. Patent & Trademark Office website. See *Patent Maintenance Fee Events (.zip) and Description Files (.txt)* (September

counting the relevant events, I found that (1) the fourth-year maintenance fee was paid for 68.09% of the patents, (2) the eighth-year maintenance fee was paid for 40.77% of the patents, and (3) the twelfth-year maintenance fee was paid for 25.11% of the patents.

With this information, I then proceeded to make several assumptions for my patent renewal model. First, I decided to model  $r(t)$  using the deterministic exponential decay function mentioned earlier in this section (Equation 2). Second, I assumed that the initial revenues,  $R_0$ , were distributed log-normally.<sup>142</sup> Third, I assumed that revenue was generated at discrete annually occurring events. Fourth, I decided to apply the maintenance fees for large entities to all patents and ignore the discounts available to small and micro entities.<sup>143</sup> Fifth, I ignored the possibility of surcharges for late maintenance fee payments. Sixth, I applied the maintenance fee schedule that was in place just before the America Invents Act<sup>144</sup> became effective to all patents.<sup>145</sup> Therefore, I assumed the fourth-year, eighth-year, and twelfth-year maintenance fees were \$980.00, \$2,480.00, and \$4,110.00 respectively for all patents.<sup>146</sup> Lastly, I set the discount rate,  $i$ , to 3.66% for all years.<sup>147</sup>

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*I, 1981 - Present*), U.S. PATENT & TRADEMARK OFFICE, <https://eipweb.uspto.gov/MaintFeeEvents/> (last visited Mar. 27, 2015). I wrote a program in AutoIt to look through this file and pull out all of the relevant maintenance fee events for the hypothetical lawsuit. *See AutoIt: Automation and Scripting Language*, *supra* note 117. The U.S. Patent & Trademark Office also offers other types of patent grant data products. *See Patent Grant Data Products*, U.S. PATENT & TRADEMARK OFFICE, <http://www.uspto.gov/learning-and-resources/electronic-data-products/patent-grant-data-products> (last visited Mar. 27, 2015).

<sup>142</sup> Most of the economic studies I reviewed for this paper made the same assumption. *See, e.g.*, Barney, *supra* note 21, at 326-27; Schankerman, *supra* note 4, at 88; Putnam, *supra* note 119, at 31; Sullivan, *supra* note 119, at 40; Schankerman & Pakes, *supra* note 119, at 1061; Pakes, *supra* note 119, at 765.

<sup>143</sup> *See Current Fee Schedule*, *supra* note 124.

<sup>144</sup> Leahy-Smith America Invents Act, Pub. L. No. 112-29, 125 Stat. 284 (2011).

<sup>145</sup> The fourth-year, eighth-year, and twelfth-year maintenance fees increased substantially after the AIA became effective. *Compare* 37 C.F.R. § 1.20 (2012), *with* 37 C.F.R. § 1.20 (2013).

<sup>146</sup> 37 C.F.R. § 1.20 (2012).

<sup>147</sup> This is the average primary credit rate since 2003. *See Historical Discount Rates*, FEDERAL RESERVE, <https://www.frbdiscountwindow.org/Pages/Discount-Rates/Historical-Discount-Rates.aspx> (last visited Mar. 16, 2015).

After making these assumptions, I was left with the task of estimating (1)  $\delta$ , the rate at which the annual revenues decay, (2)  $\mu$ , the mean of the natural log of the initial revenues, and (3)  $\sigma$ , the standard deviation of the natural log of the initial revenues. I accomplished this using the built-in solver tool in Microsoft Excel<sup>148</sup> to solve the following set of equations:

$$\$980.00 = \sum_{t=4}^7 R_{o1} e^{-(\delta+0.0366)t}, \quad (3)$$

$$\$2,480.0 = \sum_{t=8}^{11} R_{o2} e^{-(\delta+0.0366)t}, \quad (4)$$

$$\$4,110.00 = \sum_{t=12}^{19} R_{o3} e^{-(\delta+0.0366)t}, \quad (5)$$

$$100\% - 68.09\% = F(R_{o1}, \mu, \sigma), \quad (6)$$

$$100\% - 40.77\% = F(R_{o2}, \mu, \sigma), \quad (7)$$

$$100\% - 25.11\% = F(R_{o3}, \mu, \sigma), \quad (8)$$

where  $R_{o1}$ ,  $R_{o2}$ , and  $R_{o3}$  are the initial revenues for three difference scenarios;  $\delta$  is the rate of decay,  $t$  is the number of years, and  $F(R_o, \mu, \sigma)$  is the cumulative distribution function for a log-normal distribution.<sup>149</sup> Equation 3 represents the scenario where the future revenue that will be generated by a particular patent during the fourth, fifth, sixth, and seventh years of its lifetime are equal to

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<sup>148</sup> See *Load the Solver Add-in*, MICROSOFT, <https://support.office.com/en-nz/article/Load-the-Solver-Add-in-ec994cd0-a396-4bf3-a5dd-feda369cef37> (last visited Mar. 28, 2015); *Define and solve a problem by using Solver*, MICROSOFT, <https://support.office.com/en-nz/article/Define-and-solve-a-problem-by-using-Solver-5d1a388f-079d-43ac-a7eb-f63e45925040> (last visited Mar. 28, 2015).

<sup>149</sup> More information about the log-normal cumulative distribution function can be found in NATIONAL INSTITUTE OF STANDARDS AND TECHNOLOGY, E-HANDBOOK OF STATISTICAL METHODS at ch. 1.3.6.6.9 (2013), available at <http://www.itl.nist.gov/div898/handbook/index.htm>. In Microsoft Excel, the “LOGNORMDIST(x, [μ], [σ]) function returns the cumulative probability that the observed value of a Lognormal random variable with mean [μ] and standard deviation [σ] will be less than or equal to x.” *Excel statistical functions: LOGNORMDIST*, MICROSOFT, <https://support.microsoft.com/en-us/kb/828281?wa=wsignin1.0> (last visited Mar. 28, 2015).

the fourth-year maintenance fee. Equations 4 and 5 represent similar scenarios, but with respect to the eighth-year and twelfth-year maintenance fees. Equation 6 represents the fact that 31.91% of the patents reviewed do not generate enough future revenue to justify paying the fourth-year maintenance fee. Equations 7 and 8 represent analogous facts with regard to the percentage of eighth-year and twelfth-year maintenance fees paid. Ultimately, I approximated  $\delta$ ,  $\mu$ , and  $\sigma$  as 0.26, 8.53, and 3.08, respectively.

Using these approximations, I was finally able to implement my patent renewal model in Microsoft Excel. To do this, I generated 50,000 random log-normally distributed initial revenues.<sup>150</sup> I then calculated  $V(T)$  for each simulated patent as follows:

$$V(T) = \left( \sum_{t=0}^T R_o e^{-(0.26+0.0366)t} \right) - c(T), \quad T \in \{3, 7, 11, 19\}, \quad (9)$$

where

$$c(T) = \begin{cases} \$0 & \text{if } T = 3 \\ \$980 & \text{if } T = 7 \\ \$3,460 & \text{if } T = 11 \\ \$7,570 & \text{if } T = 19 \end{cases}, \quad T \in \{3, 7, 11, 19\}, \quad (10)$$

where  $R_o$  is the random log-normally distributed initial revenue,  $T$  is last year in which the patent generated revenue,  $c(T)$  is the total amount of maintenance fees paid, and  $t$  is a particular year. For all patents,  $T$  was equal to 3, 7, 11, or 19 based on a profit-maximizing renewal decision. For example, when the fourth-year maintenance fee was due, for each patent it was determined whether or not the future revenue that would be generated by that patent during the fourth, fifth, sixth, and seventh years of its lifetime justified paying the fourth-year maintenance fee. The calculations for this decision closely resembled Equation 3. Similar decisions were made with regard to the eighth-

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<sup>150</sup> Each log-normally distributed initial revenue was generated in Microsoft Excel using the following formula: “=LOGNORM.INV(RAND(),\$B\$3,\$C\$3),” where \$B\$3 was  $\mu$  and \$C\$3 was  $\sigma$ .

year and twelfth-year maintenance fees. The calculations for those decisions closely resembled Equations 4 and 5 respectively.

Next, I eliminated all outliers from the set of 50,000 simulated patents. I did this by calculating the Z-score for each simulated patent and eliminating all patents with Z-scores with an absolute value greater than 2.<sup>151</sup> A Z-score provides a numerical “unit of how many standard deviations [a particular data point] is from the mean” of all data points in the set.<sup>152</sup> It is frequently used to “identify possible outliers.”<sup>153</sup> Typically, outliers are defined as data points with Z-scores with an absolute value greater than 2.5, 3, or even 3.5.<sup>154</sup> I chose to define the set of outliers very broadly for two reasons. First, it allowed me to generate a conservative estimate for the percentage of value held by patents within a particular percentile range that was more in line with Mark Schankerman’s conservative estimates.<sup>155</sup> Second, it allowed me to remove many of the unrealistic patent values. Within the entire set of 50,000 simulated patents, the value of each patent fell somewhere between \$0.01 and \$8,016,875,724.42. Within the set of 47,471 simulated patents with

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<sup>151</sup> I calculated the Z-score for each simulated patent as follows:  $Z\text{-score} = (\ln(\text{value of the simulated patent}) - \mu) / \sigma$ , where  $\mu = \ln(\text{median of all simulated patents})$  and  $\sigma = \sqrt{2(\ln(\text{mean of all simulated patents}) - \mu)}$ . See E-HANDBOOK OF STATISTICAL METHODS, *supra* note 149, at ch. 1.3.5.17, 1.3.6.6.9; *Excel statistical functions: LOGNORMDIST*, *supra* note 149.

<sup>152</sup> E-HANDBOOK OF STATISTICAL METHODS, *supra* note 149, at ch. 1.3.5.17.

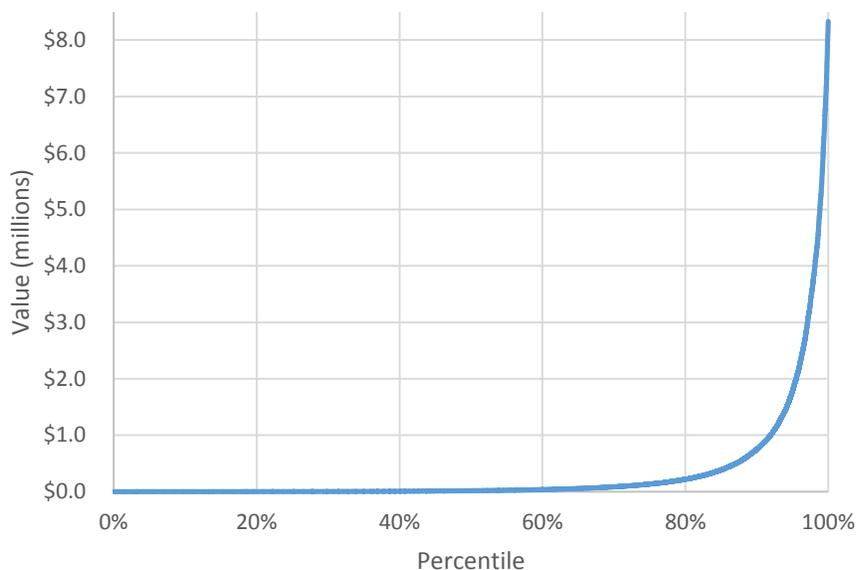
<sup>153</sup> *Id.*

<sup>154</sup> *See generally id.*

<sup>155</sup> Mark Schankerman assigned the lower bound to all patents within a particular percentile range. Schankerman, *supra* note 4, at 94 tbl.5 & n.12. What is not apparent at first is just how conservative this estimate can be. By adding up the value of all patents in the top 5% of the 50,000 simulated patents and dividing that by the total value of all 50,000 simulated patents, I found that the top 5% of simulated patents hold 91.84% of the total value. By using the exact technique described by Mark Schankerman in footnote 12, this number is reduced 21.71%. *Id.* However, I found that by eliminating all simulated patents with Z-scores with an absolute value of greater than 2, this number is reduced to 60.60%. I also found that using Mark Schankerman’s technique on this reduced set of simulated patents produced an estimate of 46.94%. The key distinction between these techniques is where the excess value goes (i.e., 91.84% minus 21.71% or 60.60%). When calculating a reasonable royalty, Mark Schankerman’s technique will have the effect of automatically assigning the excess value to the infringer. My technique distributes the excess value amongst the remaining patents, some of which might be effectively assigned to the infringer.

Z-scores with an absolute value greater than 2, the value of each patent fell somewhere between \$34.50 and \$8,328,559.69.

I then sorted the reduced set of 47,471 simulated patents and determined the percentile that each patent fell into. With this information, I was able to create the following graph:<sup>156</sup>



The area under the entire curve represents the total amount of value held by the reduced set of 47,471 simulated patents. One can see from this that the top 10% of those patents hold most of the value. Specifically, the top 10% of those patents hold 78.98% of the total value, whereas the bottom 50% of those patents hold 0.63% of the total value.

Next, I determined the percentile range that should be associated with the '127 Patent. In step two of the Modified Top-Down Approach, I determined that there are 75 applicable patents. Therefore, each applicable patent is associated with a percentile range of 1.33% (i.e, 100% divided by 75). In step three of the Modified Top-Down Approach, I determined that the '127 Patent has

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<sup>156</sup> This curve is referred to as either the inverse cumulative distribution function or the percent point function. See E-HANDBOOK OF STATISTICAL METHODS, *supra* note 149, at ch. 1.3.6.2.

a value index greater than or equal to the value index of 91.55% of the 2,248 potentially applicable patents. Therefore, if the 75 applicable patents were ranked according to their value, the '127 Patent would be the seventh most valuable patent. As a result, the '127 Patent should be associated with the following percentile range: 90.67% to 92.00%. According to my patent renewal model, patents that fall within this percentile range, hold 3.88% of the total value.

This last step would be slightly more complex if there were multiple patents in suit. According to my data, there are 29 other potentially relevant patents that would be associated with the same percentile range as the '127 Patent. If one of the other patents in suit happens to be one of these 29 patents, then there is a logical dilemma because only one patent should be assigned to a particular percentile range. There are at least two solutions to this dilemma. One can assign the percentile range associated with the eighth most valuable patent to this other patent in suit. One could also assign the percentile range associated with the sixth most valuable patent to this other patent in suit. Assigning both patents to the same percentile range can lead to absurd results. For example, according to my patent renewal model, if four patents are assigned to the top percentile range (98.67% to 100%), they would hold 106% of the total value.

The Top-Down Approach as it was described originally in *Innovatio* can be broken in the same way. Judge Holderman calculated the relative intellectual value of *Innovatio*'s patents by relying on the assertion that "the top 10% of all electronics patents account for 84% of the value in all electronics patents"<sup>157</sup> and estimating that the total number of Wi-Fi standard essential patents was 3,000.<sup>158</sup> What if the suit still involved *Innovatio*'s 19 Wi-Fi standard essential patents, but there were only 100 total Wi-Fi standard essential patents? If the calculations were performed

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<sup>157</sup> *Innovatio*, 2013 U.S. Dist. LEXIS 144061, at \*181 (citing Schankerman, *supra* note 4, at 94 tbl.5 & n.12).

<sup>158</sup> *Id.* at \*177-80.

in the same exact way, this would mean that 19 patents are in the top 10% of a set of 100 patents, which is impossible. Associating overlapping patents in suit with a neighboring percentile range avoids this problem.

**E. Calculate the initial reasonable royalty rate using these estimates.**

The last step for generating the initial estimate for the reasonable royalty rate is to apportion the estimated operating profit generated by the smallest salable patent-practicing unit based on the percentage of value held by the patent in suit. This is accomplished by simply multiplying the estimates from steps one and four of the Modified Top-Down Approach. In the hypothetical lawsuit, the project excess operating profit associated with a single “Hummingbird Hat” is \$8.80 and the percentage of value held by the ‘127 Patent is 3.88%. Therefore, the initial estimate for the reasonable royalty rate can be calculated as follows:

$$\text{Reasonably Royalty Rate} = \$8.80 \times 0.0388 = \$0.34 \text{ per unit} \quad (11)$$

**F. Adjust the initial reasonable royalty rate based on the facts.**

Recall that the need to apportion profits arises when there are no comparable licenses. Therefore, the first two *Georgia-Pacific* factors are largely irrelevant.<sup>159</sup> However, there are several other *Georgia-Pacific* factors that are important and remain unaccounted for in the Modified Top-Down Approach. In particular, factors four through six, which relate to (1) the “licensor's established policy and marketing program to maintain his patent monopoly by not licensing others to use the invention or by granting licenses under special conditions designed to preserve that monopoly,” (2) the “commercial relationship between the licensor and licensee,” and

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<sup>159</sup> See *Georgia-Pacific*, 318 F.Supp. at 1120.

(3) the “existing value of the invention to the licensor as a generator of sales of his non-patented items” respectively are not accounted for.<sup>160</sup> These are largely subjective determinations that should be considered when deciding whether or not to raise or lower the initial approximation of the reasonable royalty rate. In the hypothetical lawsuit, both parties are small entities that appear to be in similar bargaining positions. Therefore, these factors do not change the estimate.

The Modified Top-Down Approach also incorporates some of the inherent deficiencies associated with using objective indicators of value. A larger number forward citations could indicate that a patent is more valuable.<sup>161</sup> However, “it could be that older patents are cited more often simply because they have had more opportunities to be cited, since they precede a larger set of patents that could cite them.”<sup>162</sup> Similarly, a larger number of backward citation may indicate that a patent is more valuable by virtue of the fact that both the examiner and the applicant performed a more thorough prior art search and it is more likely to be valid, but it may also indicate that a patent is less valuable because it is “derivative in nature.”<sup>163</sup> The number of claims in a patent may be “an indication that an innovation is broader and of greater potential profitability,”<sup>164</sup> but it could also just be a function of the drafting style of the person that drafted the patent. Lastly, the number of classifications that a patent falls into may be an indication of the scope of the patent,<sup>165</sup> but it could also be a function of how confident the examiner was in picking the primary classification for the patent.

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<sup>160</sup> *Id.*

<sup>161</sup> See Trajtenberg, *supra* note 107, at 173-74.

<sup>162</sup> *Id.* at 176.

<sup>163</sup> See Lanjouw & Schankerman (2004), *supra* note 107, at 448.

<sup>164</sup> *Id.*

<sup>165</sup> Lerner, *supra* note 110, at 320.

Out of these concerns, I was able to test the reliability of using the number of forward citations in the hypothetical lawsuit. The ‘127 Patent has at least as many forward citations as 62.28% of the potentially applicable patents. If the set of potentially applicable patents is limited to those that were filed in 1998, the year the ‘127 Patent was filed, this number is reduced to 45.45%. By itself, this could indicate that the value of the ‘127 Patent was artificially bolstered by virtue of the fact that it is a relatively old patent. However, the overall value index of ‘127 Patent is still greater than or equal to 85.95% (as opposed to 91.55%) of the potentially applicable patents filed in 1998. Furthermore, 38.88% of the potentially applicable patents were filed before the ‘127 Patent. And most importantly, in the hypothetical lawsuit, since we are at the damages phase, we know that the ‘127 Patent is valid and that the “Hummingbird Hat” infringes the ‘127 Patent. Therefore, we would expect the ‘127 Patent to be more valuable.<sup>166</sup> As a result, while the forward citation indicator may have slightly inflated the value of the ‘127 Patent, this is not a worrisome result. The more troubling scenario would be where the patent in suit is relatively new and its value is being artificially deflated through the use of a forward citation indicator.

If anything, I would still consider reassigning the applicable percentile range for the ‘127 Patent to that of a patent ranked slightly higher and recalculating the reasonable royalty rate because (1) the ‘127 Patent definitely covers the “Hummingbird Hat” and (2) the ‘127 Patent is one of only two patents that describe a wearable bird feeder. All of the other potentially relevant patents cover smaller components of the “Hummingbird Hat.”

Lastly, recall that one of the goals of the Modified Top-Down Approach was to leave a reasonable profit for the infringer. This will happen inherently, at least in part, if an over-inclusive

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<sup>166</sup> See *Innovatio*, 2013 U.S. Dist. LEXIS 144061, at \*180.

approach is taken to defining the set of applicable patents. When there are more applicable patents, the projected operating profit calculated in the first step of the Modified Top-Down Approach must be apportioned between more patents. If the set of applicable patents includes patents that will never be asserted against the infringing party, then the portion of the operating profit that was assigned to those patents will effectively be assigned to the infringing party. Furthermore, as mentioned earlier, an over-inclusive approach also has the benefit of further distancing the infringer from admitting infringement to additional patents. However, if it turns out that this inherent mechanism for allocating profit fails to leave the infringer with a reasonable profit, then the initial estimate for the reasonable royalty rate should be adjusted accordingly.

#### **IV. Conclusion**

In *Apple Inc. v. Motorola, Inc.*, the Federal Circuit acknowledged the Top-Down Approach as “one reliable method for estimating a reasonable royalty.”<sup>167</sup> In this paper, I have not substantially altered the Top-Down Approach as it was applied by Judge Holderman in *Innovatio*. Instead, I have shown how objective indicators of value, such as forward and backward citations, can be used to provide a more objective starting point to the hypothetical negotiation. I have also shown how the Top-Down Approach can be applied without a third-party report describing the set of applicable patents. Finally, the approach I suggest for defining the set of applicable patents inherently assigns some of the operating profit to the infringing party if an over-inclusive approach is taken. The end result is a methodology for calculating a reasonable royalty that does not rely on evidence of comparable licensing agreements.<sup>168</sup>

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<sup>167</sup> 757 F.3d at 1315 (citing *Innovatio*, 2013 U.S. Dist. LEXIS 144061).

<sup>168</sup> I have posted all of the AutoIt scripts and Microsoft Excel files I created for this paper on my Google Site. See Billy Raska, *Downloads*, <https://sites.google.com/site/billyraska/downloads> (last visited Apr. 19, 2015).