A Decision Model for Purchasing the Highest Value Printer for Student Home Use

Team 7 Term Project Report

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Executive Summary

Students have a wide selection of printers to choose from, with a variety of technologies and features making a purchasing decision difficult. Using our group members as experts, and scope focused on multifunction, or “all-in-one”, printers to provide a single solution for all of our printing, copying, and scanning needs. Multi-function printers have become more popular and affordable. This paper presents six criteria expert users of all-in-one printers, have identified as critical in purchasing an all-in-one printer for student home use. These six criteria were applied to an HDM (Hierarchical Decision Model), a decision making tool for addressing this problem.

A review of related literature and studies provided background information on hierarchical decision-making. Pairwise Comparisons and the Pairwise Comparison Method (PCM) were used to analyze the numerical rankings for each criterion given by each expert.

By referencing the hierarchical decision-making model and the results gathered from Pairwise Comparisons, a prospective printer buyer could optimise their selection of a printer for student home use. The paper concludes with sensitivity analysis and recommendations for purchasing a multifunctional printer for student home use, based on the HDM presented in the study. The results and analysis demonstrated that HP PhotoSmart C4580 is the most important alternative that meets the problem objective “Highest Value All in one Printer” between $100 and $200.

1. INTRODUCTION

As the world continues to be more complex, decision making under conflicting objectives also becomes difficult. [8][9] However, there are many tools designed to help decision makers in making better informed choices by breaking down the problem into a series of logical and structured hierarchical steps [8] Ultimately, helping decision maker(s) with better informed choices and easier understanding of alternatives. Thus, a topic was first set to gain an understanding of decision making and its application to commonplace consumer purchasing decisions; this paper will discuss choosing a printer to purchase for a student home user.

The personal printer market offers several printers with built in 802.11g wireless, no fax, with scan, and copy functionality, these are some of what are known as all-in-one printers.[12], [16], [20], [21]

A Hierarchical Decision Model (HDM) with sensitivity analysis was created for a student home user to make a good purchasing decision. The team members will serve as experts in identifying, ranking and conducting sensitivity analysis of all alternatives in the HDM. The sources used for selection were various websites from popular printer manufacturers, such as Hewlett Packard, Canon, Epson, and Brother.[12], [16], [20], [21] The printer manufacturers' websites provided the specifications, in Appendix 1, used to develop the criteria and alternatives in this paper.

The first section will cover the goals of this study and assumptions. Then the research methodology will be discussed to understand scope, limitations, literature review and criteria used. Next, the conceptual framework: HDM, Pairwise Comparisons and Sensitivity Analysis. The final sections will cover the recommendations, conclusions and lessons learned.

1.1 GOALS OF THE STUDY

The objective statement is an example of a multi-criteria problem. The study contributes to the growing number of related literature in Engineering Management that applies theoretical framework and empirical analysis to the concept of decision-making. This paper will focus on one of these tools (i.e. Hierarchical Decision Model).

The project aims to achieve the following:

- To gain an understanding of decision-making and its application to commonplace consumer purchasing decisions.
- To identify a suitable decision model for purchasing an All-in-one printer for student home use.

- To make recommendations for optimising a decision for purchasing a printer using the notations and results from appropriate Decision Model(s) and sensitivity analysis.

1.2 ASSUMPTIONS

The following assumptions were made in this project:

- The project team members are the experts thus providing Pairwise Comparison values.
- Six "experts" requiring purchasing a printer for student home use.
- Experts have a limited budget of $200 and would not choose a new printer under $100.
- Criteria and decision alternatives identified are key factors to purchasing a home printer for a student.
- All conditions in the decision process will remain constant (e.g. no new versions of printer models, no changes in price, etc).
- All levels identified in the decision hierarchy are sufficient to give a valid evaluation of the decision problem to student home user.
- Experts consider any specification not stated in the criteria of no importance to the HDM.

2. RESEARCH METHODOLOGY

2.1 SCOPE AND LIMITATIONS

2.1.1 SCOPE INCLUSIONS

There are several home printer models that have a range of features appealing to student home user. The following components are within the scope of this project:

Printer price range and Functionality - all experts determined acceptable price range of $100 to $200. Experts defined "value" as all-in-one Printer with scanning, copying, card reader, and 802.11 wireless networking.[12], [16], [20], [21] This objective was used to search manufactures' website for available products for the HDM. Figure 1 below is an illustration of the impact level for this project here in referred to as the objective level.

Figure 1: Level 1 Objective

2.1.2 LIMITATIONS

Printer models used in this study may already be obsolete due to technological advancement. Additionally, another prospective buyer's criteria may change in time. The criteria used by experts in this study are expected to differ for others. However, the prospective buyer of a home printer who is reading this study is encouraged to consider this approach and adapt the HDM to their set of purchasing criteria.

Time pressures did not allow the team members to conduct additional research in the areas of: (1) additional surveys to improve data gathering, (2) applying utility theory and (3) Total Cost of ownership.

2.2 METHODOLOGY

The objective of our project was to use a decision model to purchase the highest "value" printer for student home use. After, searching websites, four vendors and six printer alternatives met the defined criteria. All six team members were experts in the printer selection process. The following items were used for the methodology:

- Literature Review
  - Relevant HDM models
  - Defined criteria from Manufactures product specifications
- Model
  - HDM
  - Pairwise Comparisons for each level of the HDM
  - Calculations to determine overall printer weightings
  - Sensitivity Analysis

The following section will describe each of these in more detail.

2.2.1 LITERATURE REVIEW

As part of the research methodology, a preliminary literature review of this topic was conducted in order to familiarize with the concepts of decision-making. The selection of a printer is an example of a multi-criteria decision.

Researchers and students have conducted numerous examples of the art of decision making with multiple criteria. Baird (1989) argues that a decision and its process must be defensible to superiors, subordinates and peers [4]. On this note, the methodology used in this paper in regard to the printer decision process will attempt to answer the following questions for it to be justifiable; (1) What alternatives were available? (2) What criteria were used? (3) What order of importance was assumed? (4) How was each alternative evaluated in terms of the criteria? (5) How was a particular course of action (i.e. decision alternative) single out as best?

Multi-criteria decisions are more complex than single-criterion ones because of the difficulty of finding an alternative that outweighs all others with respect to all criteria [8]. Therefore, there is a need to break the problem down and represent it in a much simpler form. The Hierarchical Decision Model becomes useful in this instance.

Majority of the work conducted in this field follow a fundamental approach of breaking the decision problem down into manageable chunks represented by the following steps [5]:

1. Identify the issue that triggers a decision process
2. Formulate a model
3. Data gathering
4. Solving the model (i.e. defining criteria and sub-criteria)
5. Results interpretation (could be from judgment quantification/Pairwise Comparisons among alternatives, utility curves, sensitivity analysis)
6. Implementation of the results

The typical starting point to trigger a decision process is the establishment of objectives such as in this paper (e.g. Purchasing the highest value printer at the least cost for student home use) [11].

Examples of related work in the application of Hierarchical Decision Modelling include:

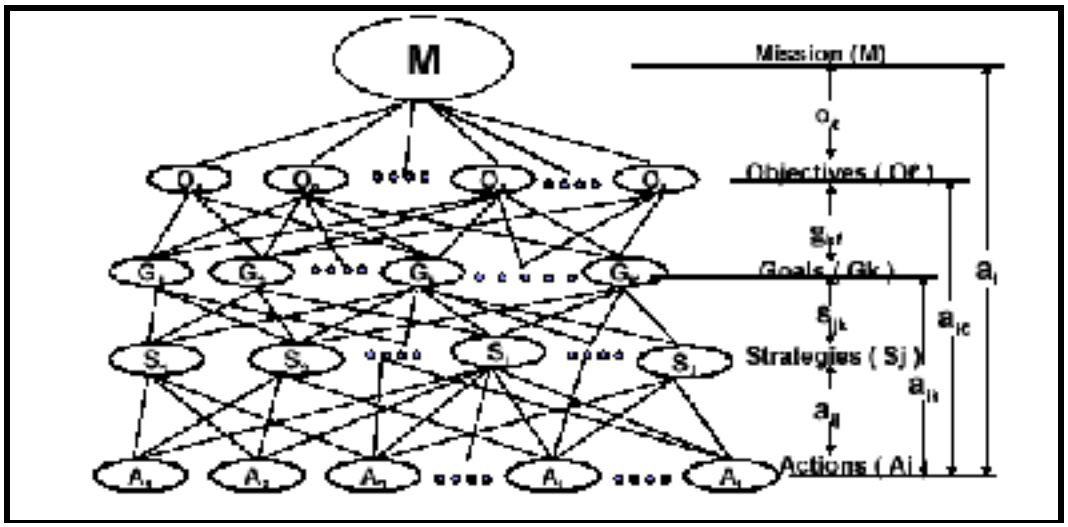
- Selection of Laptop [11]
- Selection of Mobile phone [7]
- Fleet Vehicle Purchase[2]
- Selecting a Vacation[10]
- Site selection of a major league baseball stadium in Portland [1]

2.2.2 GENERAL HDM

MOGSA is a Hierarchical Decision Model (HDM) tool developed in 1981 by Cleland and Kocaoglu in order for determining trade-offs with multiple criteria decisions.[8] The HDM model uses a framework of hierarchical

levels to represent the problem and important criteria for both qualitative and quantitative assessments. Typically there is the first level that is a clear problem statement, referred in the HDM model as objective. The middle level represents the criteria and number of levels is dependent on the hierarchy and decision alternatives. The final level represents the decision alternatives to the decision maker. Therefore, model is adaptable for appropriate levels for evaluation of a problem. See Figure 2 of a typical MOGSA HDM. [4]

Figure 2: MOGSA Hierarchical Decision Model [4]



"The appropriate number of levels is the first challenge in HDM model. Too much information and level will demand significantly more information and measurements. Additionally, too few levels will create another challenge of not representing the problem correctly leading to improper results."[8] As a result, building the model and levels becomes the most work both as challenge to get the right amount of levels and criteria that represents the problem correctly for all experts to use while evaluating alternatives.

Additional benefit of flexibility using a HDM model, once created, there are several methods used to evaluate the alternatives: 1) Analytic Hierarchy Process (AHP), 2) column-row orientation, 3) constant-sum, or 4) least distance approximations.[8-9], [11] These methods are used to rank alternatives in HDM models and to provide a recommendation.

2.2.3 PAIRWISE COMPARISONS

Pairwise Comparison is the process of comparing elements in pairs to determine which one has a higher numerical value, which one is preferred, or most likely to occur.[3][8]. In this paper, the preference was shown by splitting 100 points, whole integers only, between the elements in each comparison for likely hood of occurrence.[3] For example:

A=75 and B=25 (A is 3 times more likely to occur than B)

A=50 and B=50 (A and B are equally preferred)

A=99 and B=1 (Extreme case is A is 99 relative to B of 1; 0 is not acceptable)

This method allows a researcher to determine the relative order or ranking of elements in a group or collection. The Pairwise Comparison method is an unbiased mathematical technique that quantifies subjective preferences or perceptions into objective normalized weights. In this study, the experts used PCM software (Pairwise Comparison Method) to calculate the rankings of the elements at each level of the HDM.

3. CONCEPTUAL FRAMEWORK

3.1 HDM AND PAIRWISE COMPARISONS

3.1.1 DEFINITIONS AND RATIONAL OF LEVEL 2 CRITERIA

After the problem and objective were defined, the next step is the level 2 criteria of the HDM. Again the most time was spent here with all experts to agree and define appropriate criteria that were not too much or too few information and measurements. Experts determined critical criteria for purchasing as follows: (1) Brand, (2) Price, (3) Scan Resolution, (4) Black Print Speed, (5) Dimensions, and (6) Weight, see Figure 3. Definitions and rational of the six identified criteria are given below:

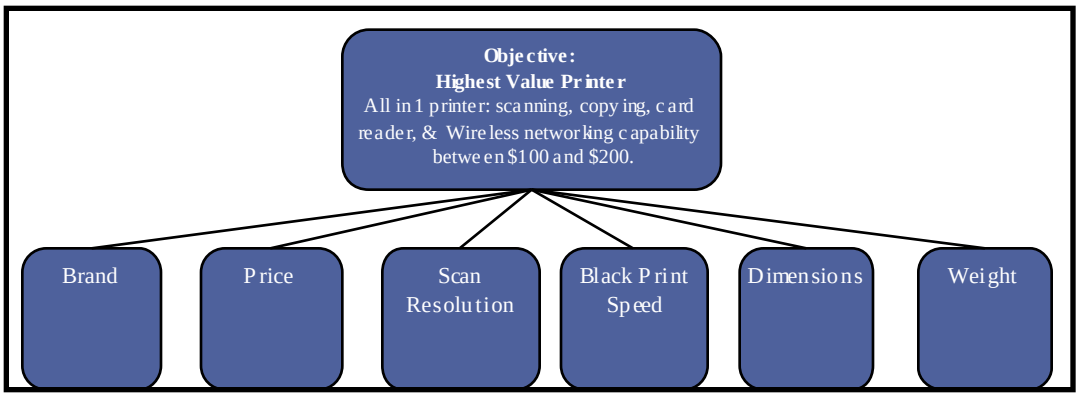
- **Brand** – refers to printer manufacturer name and model series experience or expectation associated with a product. [14], [6]
  Brand can indicate the usability, quality, warranty, service and the reliability of the printer.
- **Price** – defined as below $200 for a home printer with prices of a new printer given by manufacturer.[13] All experts are not able to afford a printer that is over $200 and would not pay for a printer under $100, due to quality, serviceability and reliability.
- **Scan Resolution** - refers to the amount of information, calculated in dots per inch, which the scanner can read. More dots equal higher resolution, and thus better-looking scans (low-resolution scans sometimes have big and obvious squares of pixels). All data provided by manufacturer. [19] The scan resolution used for comparison is always the lower of the two numbers provided. (ie 1200x2400 would use 1200) [17]
- **Black Print speed** - is measured by the pages per minute (ppm) or copies per minute (cpm). This measurement applies to printers with copier features. Speed is the number of pages a laser or inkjet printer can produce in one minute. Generally the speed increases as the price of the printer increases. Normally inkjet and laser printers have 3 levels of quality settings: draft, normal, best. The higher the quality,

the lower the print speed. All data provided by manufacturer.[18] As a student it is important to have speed for last minute deadlines and time is important not to waste.

§ **Dimensions** - are measured by WxDxH (Weight x Depth x Height) of a printer. [19] As a student, space is not always available (i.e. books, desk dimensions, room configurations, etc.)

§ **Weight** –expresses the mass of the printer, measured in lbs.[15] Space restriction can require moving the printer for use and may also require using shelves that have weight limitations.

Figure 3: Level 2 Criteria



After the Level 2 was defined, more research was done on manufactures' specifications to find the alternatives that contained each of the Level 2 criteria and Level 1 objectives. Six alternatives were identified as meeting the defined criteria: HP Photosmart C4580, HP Photosmart C4599, HP Photosmart C6380, Canon Pixma MP620, Brother DCP-585CW, and Epson Artisan 700. These are illustrated in *Figure 4: Printer Alternatives with Manufactures' Specifications.*

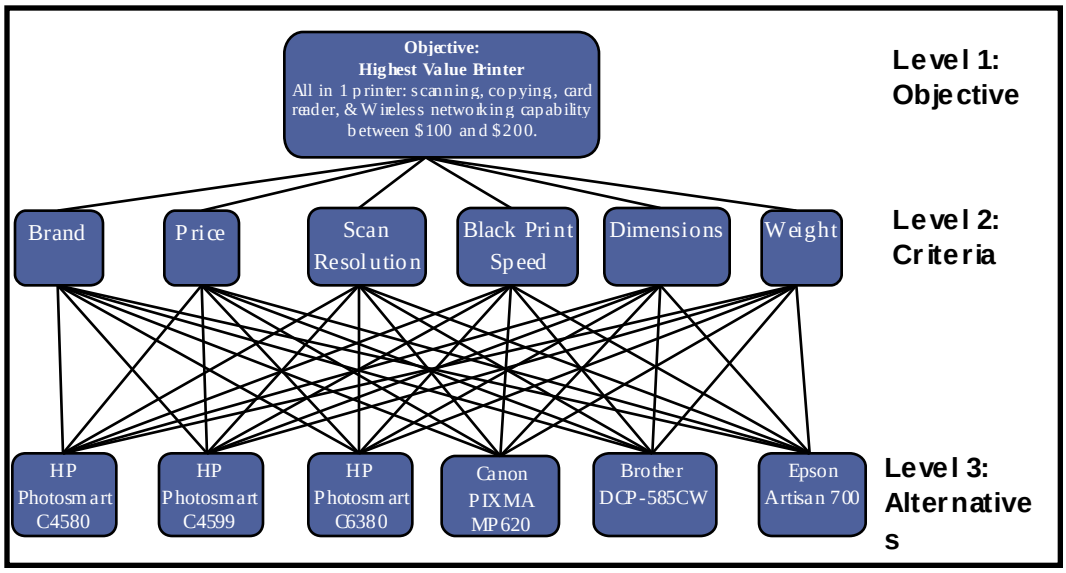
Figure 4: Printer Alternatives with Manufactures' Specifications

			
Product Comparison	**HP Photosmart C4580**	**HP Photosmart C4599**	**HP Photosmart C6380**
Price	$104.99	$149.99	$179.99
Black print speed (max)	30 cpm	30 cpm	33 cpm
Dimensions	17.09 x 11.42 x 6.38 in	17.09 x 11.42 x 6.38 in	17.79 x 15.97 x 8.17 in
Weight	11.16 lb	11.16 lb	16.4 lb
Scan resoluiton	1200 dpi	1200 dpi	4800 dpi

			
Product Comparison	**Canon PIXMA MP620**	**Brother DCP-585CW**	**Epson Artisan 700**
Price	$149	$119.99	$149.99
Black print speed (max)	26 ppm	33 ppm	38 ppm
Dimensions	17.8 x 14.5 x 6.9 in	15.4 x 14.4 x 5.9 in	17.6 x 23 x 5.9 in
Weight	18.7 lb	15.7 lb	20.5 lb
Scan resoluiton	2400 x 4800 dpi	1200 x 2400 dpi	2400 dpi

These six alternatives were then used to construct the final HDM in Figure 5:HDM Highest "Value" Printer. The first level of the HDM is the objective, the second level is the critical criteria, and the third level is the alternatives that met the defined criteria.

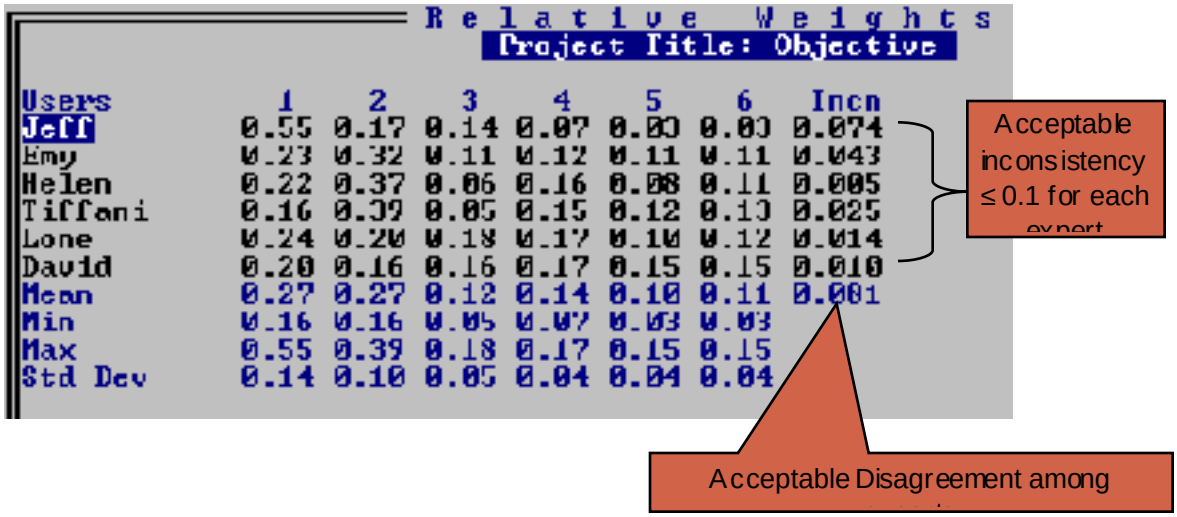
Figure 5: HDM Highest "Value" Printer



3.1.2 CRITERIA WEIGHTING

The PCM software was used for each level to determine the combined preference of all experts. PCM is a software product that utilizes a Pairwise Comparison method of judgement quantification. When used as a group, the PCM software allows perceptions to be normalized into objective weights. It additionally provides a measure of disagreement among all experts and the inconsistency (internal) for each individual. Generally, a value of < 0.10 is an acceptable level of inconsistency.[8] Disagreement is defined as "A measure of how similar the respondents' comparisons were. A value near zero indicates that all respondents entered very close weights." [3] Therefore, lower values of both disagreement and inconsistency will help ensure quality weight assessment.[3] Arriving at acceptable values can be time intensive to get all experts agree.

Figure 6: PCM Screen Shot of Objective vs. Criteria

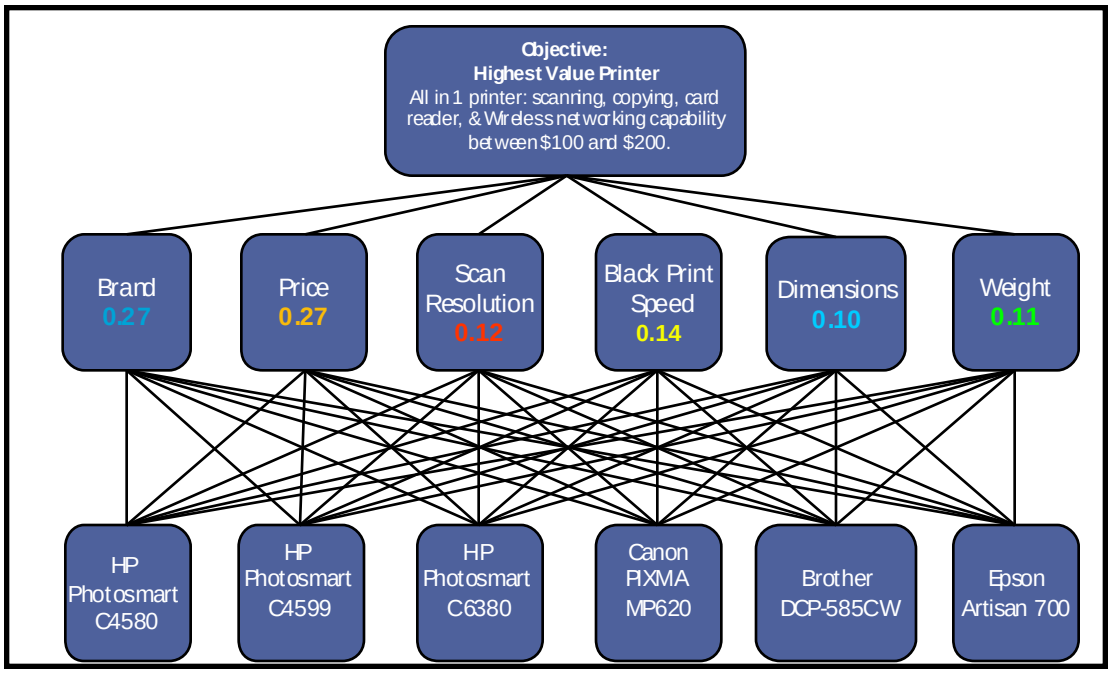


In **Figure 6: PCM Screen Shot of Objective vs. Criteria** the mean for each criterion becomes the PCM's relative weights for Level 2 criteria. The following list the values compared relative to the Objective that were added to the HDM for Level 2, see figure 7 HDM Level 2 Comparison Results:

- Brand: 0.27
- Price: 0.27
- Scan Resolution: 0.12
- Black Print Speed: 0.14
- Dimensions: 0.10
- Weight: 0.11

Weights for Level 2 will be used later in calculations to determine the recommended printer. Relative weights, provided by the PCM, both Brand and Price as most important, followed by Black Print Speed and Scan Resolution, and last was Dimensions and Weight. Experts agreed this seemed logical and verified their judgments.

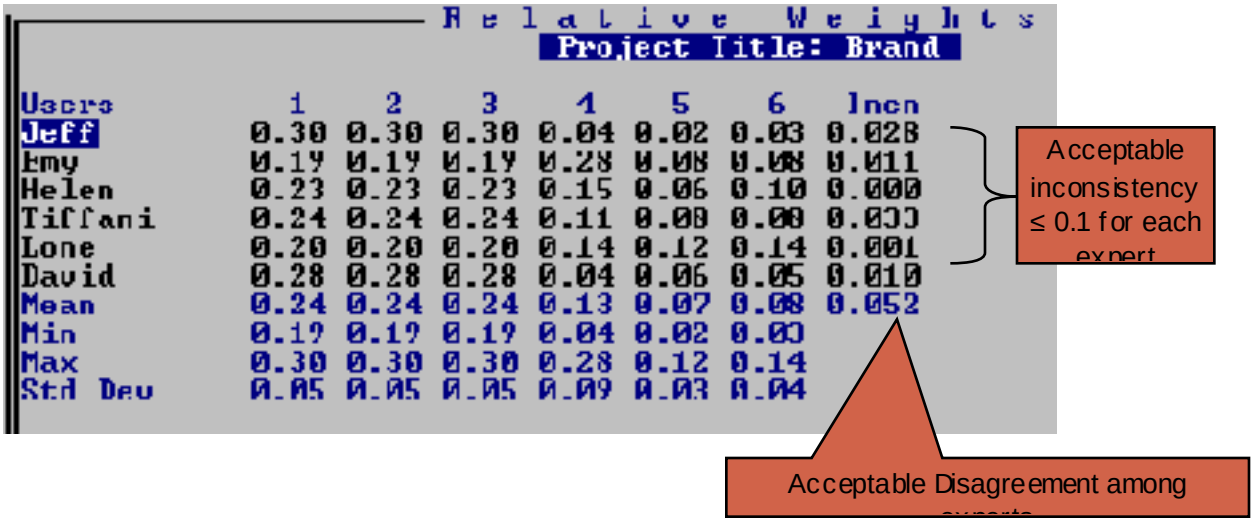
Figure 7: HDM Level 2 Comparison Results



3.2 ANALYSIS OF HDM & PCM RESULTS

The PCM software was used to determine the alternative weightings relative to each of the level 2 criterion, refer to Appendix 1. In **Figure 8:PCM Snapshot Of Brand Vs. Alternatives**, the HP models are evident by the values in columns 1, 2, and 3 being equally preferred by each expert. Additionally, for brand, disagreement among all experts and inconsistency for each individual had relatively low value, an acceptable level among experts.

Figure 8:PCM Snapshot Of Brand Vs. Alternatives



Each of the level 3 relative values was combined with the relative level 2 values to determine the preference of each alternative. The calculations are shown for HP Photosmart C4580. Brand, Price, Scan Resolution, Black Print Speed, Dimension, and Weight represent the values identified for HP Photosmart C4580 through the PCM software. Figure 9 Example Calculation for HP Photosmart C4580 is an illustration of an example calculation for the contribution of a decision criterion to the overall

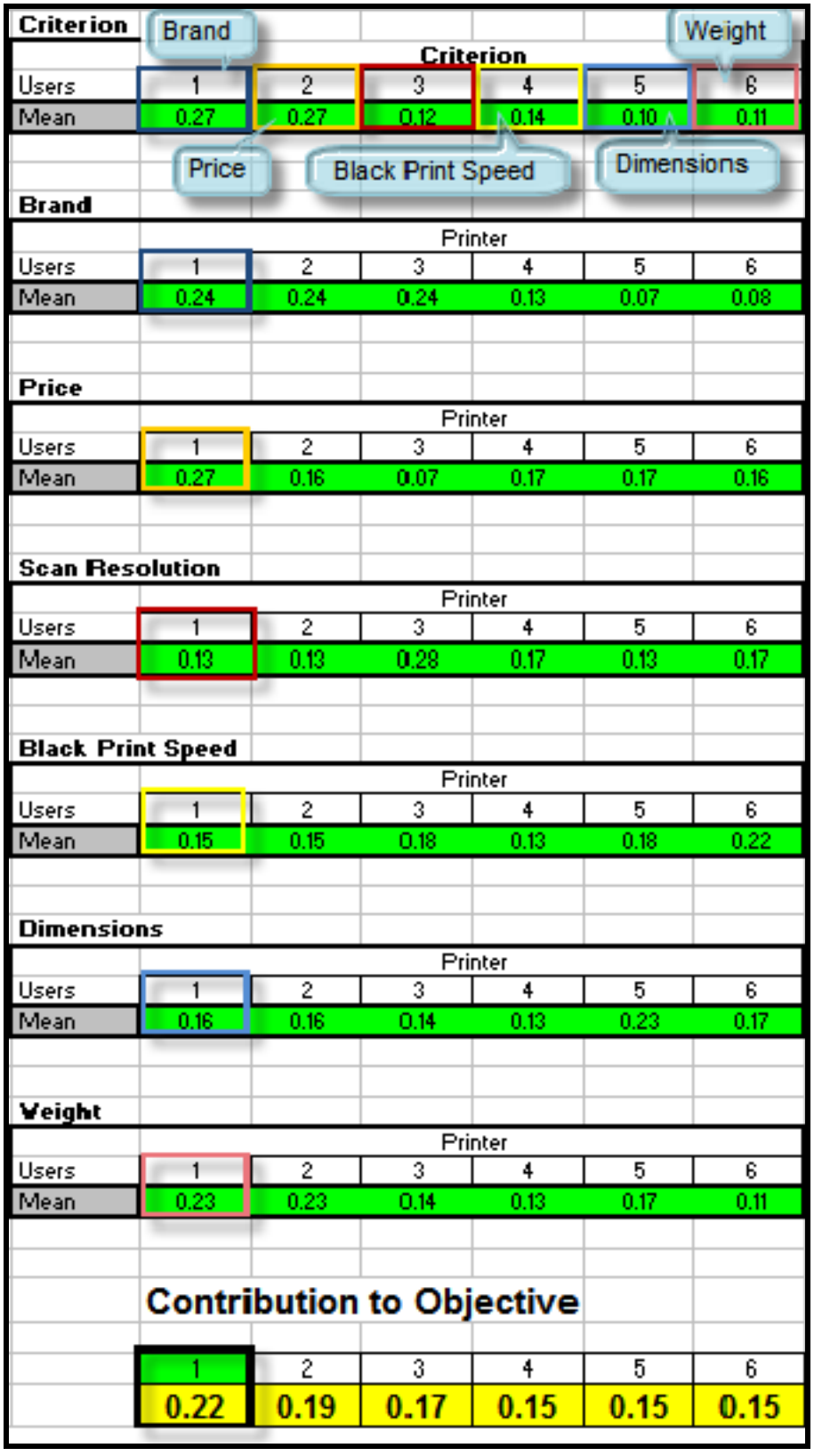
Figure 9: Example Calculation for HP Photosmart C4580

(Brand * Alternative 1) + (Price * Alternative 2) + (Scan Res. * Alternative 3) + (Blck Print Spd * Alternative 4) + (Dim. * Alternative 5) + (Weight * Alternative 6) = 0.22 HP Photosmart C4580

The value calculated in Figure 9 Example Calculation for HP Photosmart C4580 above, represents the relative weight or contribution of a decision alternative to the overall objective. The higher this value, the more important is the criterion to the overall objective. This is referred to as criterion importance and defined as criterion corresponding to the biggest contribution value or one that contributes the most to the overall objective.[4]

Figure 10: Contribution to Overall Objective *display example Calculation for HP Photosmart C4580. To help illustrate the calculations, the excel image contains colored boxes that correspond to the coloring of criteria weightings in level 2 of the HDM in* **Figure 7: HDM Level 2 Comparison Results**.

Figure 10: Contribution to Overall Objective



Results were computed by multiplying the weight of each criteria and the weight each printer model had for each criteria.

HP PhotoSmart C4580:
(0.24*0.27) + (0.27*0.27) + (0.13*0.12) + (0.15*0.14) + (0.16 *0.10) + (0.23*0.11) = **0.22**

HP PhotoSmart C4599:
(0.24*0.27) + (0.16*0.27) + (0.13*0.12) + (0.15*0.14) + (0.16 *0.10) + (0.23*0.11) = **0.19**

HP PhotoSmart C6380:
(0.24*0.27) + (0.07*0.27) + (0.28*0.12) + (0.18*0.14) + (0.14 *0.10) + (0.14*0.11) = **0.17**

Canon PIXMA MP620:
(0.13*0.27) + (0.17*0.27) + (0.17*0.12) + (0.13*0.14) + (0.13 *0.10) + (0.13*0.11) = **0.15**

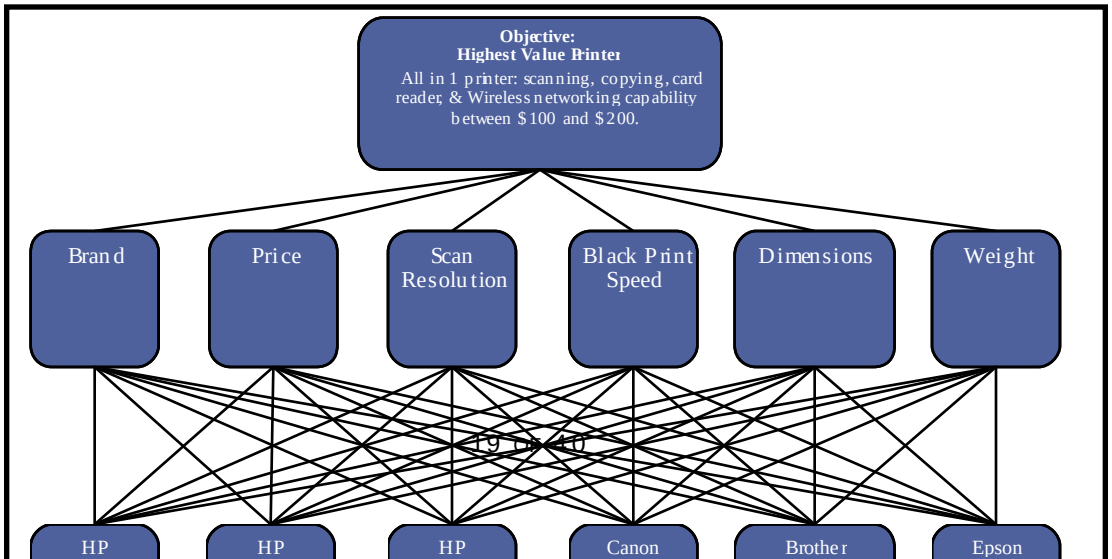
Brother DCP 585CW:
(0.07*0.27) + (0.17*0.27) + (0.13*0.12) + (0.18*0.14) + (0.23 *0.10) + (0.17*0.11) = **0.15**

Epson Artisan 700:
(0.08*0.27) + (0.16*0.27) + (0.17*0.12) + (0.22*0.14) + (0.17 *0.10) + (0.11*0.11) = **0.15**

4. RECOMMENDATION

Based on the experts' input, alternative 1, HP PhotoSmart C4580 (value of 0.22), is the highest "value" printer since it has the largest contribution to the overall objective as defined in Section 3.2. ANALYSIS OF HDM & PCM RESULTS. Second and third highest "value" printers were close behind with contribution values of 0.19 and 0.17 for HP PhotoSmart C4599 and HP PhotoSmart C6380 respectively, shown in **Figure 11: HDM Level 3 Alternative Weightings**.

Figure 11: HDM Level 3 Alternative Weightings



5. SENSITIVITY ANALYSIS

Sensitivity analysis is defined as "the careful study of the responsiveness of conclusions to changes or errors in parameter values and assumptions." [5]. It is used to improve the HDM by identifying when changes in expert values might impact the preference of alternatives.

The sensitivity analysis conducted in this study, shows the impact of each criterion on the weighting of the alternatives by using a dominant criterion. To calculate the value of dominance, the weight values range from 0.01 to 0.99.
Two different analyses were conducted: 1) extreme value of dominance and 2) mean value of dominance.

There will be five criteria dominated by the sixth criterion, expressed below:

Extreme value of Dominance: 1 - [(5 criteria)*(0.01)] = 0.95

Mean Value of Dominance: 1 - [(5 criteria) *(0.10)] = 0.50

Below shows each Level 2 criterion results of the calculations of dominated criterion:

Brand

As expected, when extreme value dominant, HP alternatives 1, 2 and 3, are equally weighted, see **Table 1: Weightings for Brand (Extreme Value 0.95)**. There is indifference among the three HP alternatives.

Table 1: Weightings for Brand (Extreme Value 0.95)

Brand						
	Criterion					
	1	2	3	4	5	6
	0.95	0.01	0.01	0.01	0.01	0.01
	Contribution to Objective					
	1	2	3	4	5	6
	0.24	0.24	0.24	0.13	0.08	0.08

With mean value dominant, alternatives do not change, see **Table 2: Weightings for Brand (Mean Value 0.50)**.

Table 2: Weightings for Brand (Mean Value 0.50)

Brand						
	Criterion					
	1	2	3	4	5	6
	0.50	0.10	0.10	0.10	0.10	0.10
	Contribution to Objective					
	1	2	3	4	5	6
	0.21	**0.20**	**0.20**	**0.14**	**0.12**	**0.12**

Price:

As expected, when extreme value dominant, the least expensive model is chosen, see **Table 3: Weightings for Price**.

Table 3: Weightings for Price (Extreme Value 0.95)

Price						
	Criterion					
	1	2	3	4	5	6
	0.01	0.95	0.01	0.01	0.01	0.01
	Contribution to Objective					
	1	2	3	4	5	6
	0.27	**0.16**	**0.08**	**0.17**	**0.17**	**0.16**

With mean value dominant, the alternative does not change, see **Table 4: Weightings for Price (Mean Value 0.50)**.

Table 4: Weightings for Price (Mean Value 0.50)

Price						
	Criterion					
	1	2	3	4	5	6
	0.10	0.50	0.10	0.10	0.10	0.10
	Contribution to Objective					
	1	2	3	4	5	6
	0.23	**0.17**	**0.13**	**0.15**	**0.16**	**0.16**

Scan Resolution:
As expected, with extreme value dominant, the alternative with the highest scan resolution received the highest weighting, see **Table 6: Weightings for Scan Resolution**.

Table 5: Weightings for Scan Resolution (Extreme Value 0.95)

Scan Resolution						
	Criterion					
	1	2	3	4	5	6
	0.01	0.01	0.95	0.01	0.01	0.01
	Contribution to Objective					
	1	2	3	4	5	6
	0.13	**0.13**	**0.27**	**0.17**	**0.13**	**0.17**

With mean value dominant, the alternative does not change, see **Table 6: Weightings for Scan Resolution**.

Table 6: Weightings for Scan Resolution (Mean Value 0.50)

Scan Resolution						
	Criterion					
	1	2	3	4	5	6
	0.10	0.10	0.50	0.10	0.10	0.10
	Contribution to Objective					
	1	2	3	4	5	6
	0.17	**0.16**	**0.22**	**0.15**	**0.15**	**0.16**

Black Print Speed:

As expected, when extreme value dominant, the alternative with the greatest print speed received the highest weighting, see **Table 7: Weightings for Black Print Speed (Extreme Value 0.95)**.

Table 7: Weightings for Black Print Speed (Extreme Value 0.95)

Black Print Speed					
Criterion					
1	2	3	4	5	6
0.01	0.01	0.01	0.95	0.01	0.01
Contribution to Objective					
1	2	3	4	5	6
0.15	**0.15**	**0.18**	**0.13**	**0.18**	**0.22**

In contrast, with mean value dominant, there is indifference among five of the six alternatives, see **Table 8: Weightings for Black Print Speed (Mean Value 0.50)**. Showing black print speed is sensitive to changes in Level 2 criteria weightings.

Table 8: Weightings for Black Print Speed (Mean Value 0.50)

Black Print Speed					
Criterion					
1	2	3	4	5	6
0.10	0.10	0.10	0.50	0.10	0.10
Contribution to Objective					
1	2	3	4	5	6
0.18	**0.17**	**0.18**	**0.14**	**0.17**	**0.18**

Dimensions:

WxDxH is not intuitive to predict, since each dimension may have a different importance to an expert.

When extreme value dominant, the alternative 5 was chosen, see **Table 9: Weightings for Dimensions (Extreme Value 0.95)**. In contrast, with mean value dominant, there is indifference among three of the six alternatives, see **Table 9: Weightings for Dimensions (Extreme Value 0.95)**. Showing dimensions is sensitive to changes in Level 2 criteria weightings.

Table 9: Weightings for Dimensions (Extreme Value 0.95)

Dimensions						
	Criterion					
	1	2	3	4	5	6
	0.01	0.01	0.01	0.01	0.95	0.01
	Contribution to Objective					
	1	2	3	4	5	6
	0.16	**0.16**	**0.14**	**0.13**	**0.23**	**0.17**

In contrast, with mean value dominant, there is indifference among three of the six alternatives, see

Table 10: Weightings for Dimensions (Mean Value 0.50). Showing dimensions is sensitive to changes in Level 2 criteria weightings.

Table 10: Weightings for Dimensions (Mean Value 0.50)

Dimensions						
	Criterion					
	1	2	3	4	5	6
	0.10	0.10	0.10	0.10	0.50	0.10
	Contribution to Objective					
	1	2	3	4	5	6
	0.18	**0.17**	**0.16**	**0.14**	**0.19**	**0.16**

Weight:

As expected, when Weight is dominant, the alternatives with the lowest weight (lbs.) received the highest weighting, see **Table 11: Weightings for Weight (Extreme Value 0.95)**

Table 11: Weightings for Weight (Extreme Value 0.95)

Weight						
	Criterion					
	1	2	3	4	5	6
	0.01	0.01	0.01	0.01	0.01	0.95
Contribution to Objective						
	1	2	3	4	5	6
	0.23	0.23	0.14	0.13	0.17	0.11

With mean value dominant, the alternative does not change, see **Table 12: Weightings for Weight (Mean Value 0.50)**.

Table 12: Weightings for Weight (Mean Value 0.50)

Weight						
	Criterion					
	1	2	3	4	5	6
	0.10	0.10	0.10	0.10	0.10	0.50
Contribution to Objective						
	1	2	3	4	5	6
	0.21	0.20	0.16	0.14	0.16	0.14

Table 13: Summary of Sensitivity Analysis compares the Extreme and Mean Value Dominant alternatives and their contribution to the objective. Although the expert recommendation from HDM is alternative 1, HP Photosmart C4580 (value of 0.22), the sensitivity analysis provides confidence in the recommendation. The key points are listed below:

- Black Print Speed and Dimensions are sensitive, within this dominance range, to change the recommendations.
- Mean Value Dominant had five criterion that confirmed the HP Photosmart C4580 as the highest value printer.
- Extreme Value had three criterion that confirmed the HP Photosmart C4580 as the highest value printer.
- Extreme Sensitivity Analysis also confirms that the model behaves as expected by the experts.

Table 13: Summary of Sensitivity Analysis

Dominant Criterion	Extreme Value Dominant Alternative(s)	Mean Value Dominant Alternative(s)
Brand	**HP Photosmart C4580 (0.24)** HP Photosmart C4599 (0.24) HP Photosmart C6380 (0.24)	**HP Photosmart C4580 (0.21)** HP Photosmart C4599 (0.20) HP Photosmart C6381 (0.20)
Price	**HP Photosmart C4580 (0.27)**	**HP Photosmart C4580 (0.23)**
Scan Resolution	HP Photosmart C6380 (0.27)	HP Photosmart C6380 (0.22)
Black Print Speed	Epson Artisan 700 (0.22)	**HP Photosmart C4580 (0.18)** HP Photosmart C4599 (0.17) HP Photosmart C6381 (0.18) Brother DCP-585CW (0.17) Epson Artisan 700 (0.18)
Dimensions	Brother DCP-585CW (0.23)	**HP Photosmart C4580 (0.18)** HP Photosmart C4599 (0.17) Brother DCP-585CW (0.19)
Weight	**HP Photosmart C4580 (0.23)** HP Photosmart C4599 (0.23)	**HP Photosmart C4580 (0.21)** HP Photosmart C4599 (0.20)

6. CONCLUSION, LESSONS LEANED AND FUTURE WORK

6.1 CONCLUSION

HP PhotoSmart C4580 is clearly the highest "value" printer for these experts using the HDM. **Figure 12: Final Recommendation of HP PhotoSmart C4580**

shows the recommended printer model's specifications in relation to the identified criteria.

Figure 12: Final Recommendation of HP PhotoSmart C4580

rice	$104.99
ack print speed (max)	30 cpm
mensions	17.09 x 11.42 x 6.38 i
eight	11.16 lb

The sensitivity analysis also identifies it as a preferred printer for three out of six criteria, indicating that the preferred printer is only expected to change if scan resolution, black print speed, dimensions are preferred over the other three criteria.

6.2 LESSONS LEARNED

The lessons from conducting this study are outlined below:

- The scope of project takes diligence and time to ensure a suitable Hierarchical Decision Model that correctly represents the problem. This is particularly important in identifying an optimal decision alternative.
- The model helps utilize a multitude of criteria by applying an empirical analysis for a good decision making process.
- The analysis of PCM helps to align the expert's judgment quantification in order to understand and reach a consensus on the most important criteria and how each criterion impacts the overall objective.
- Using Pairwise Comparisons allowed experts (group members) to simplify the analysis of the HDM.

6.3 FUTURE WORK

Further sensitivity analysis could be done to define the range of tolerances, perturbation both for single and multiple. Each of the criteria can change before they impact the preferred alternative.

Total Cost of Ownership (TCO) was discussed as another possible criterion among the experts to rank. However, the experts realized that TCO could include several sub-criteria such as printer toner cost, paper, technical support and repairs and goes beyond the initial purchase price established in the scope of the project. TCO can still be included in future studies related to purchasing consumer electronics. Due to time constraints, TCO was not included in this study.

Utility curves were also not considered. Future models with utility curves could be adapted to input, instead of specific criteria only. This may allow

the model to be used for a broader range of alternatives than specifically to a student home user.

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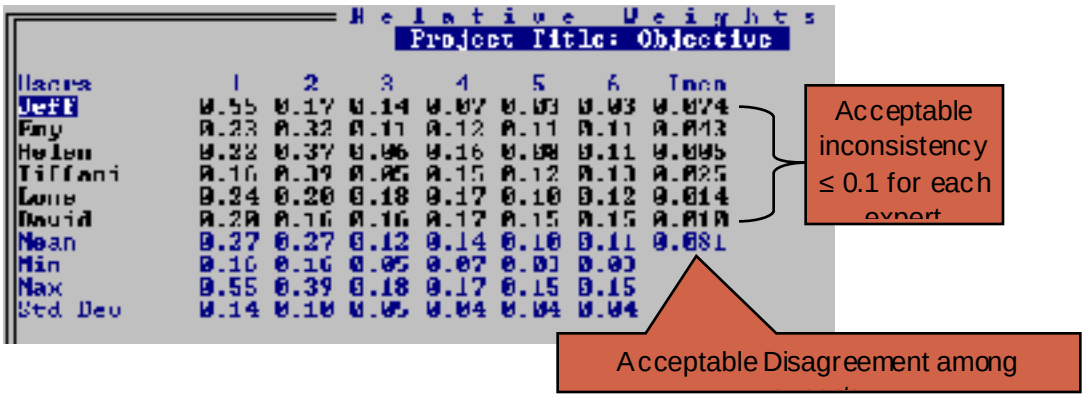
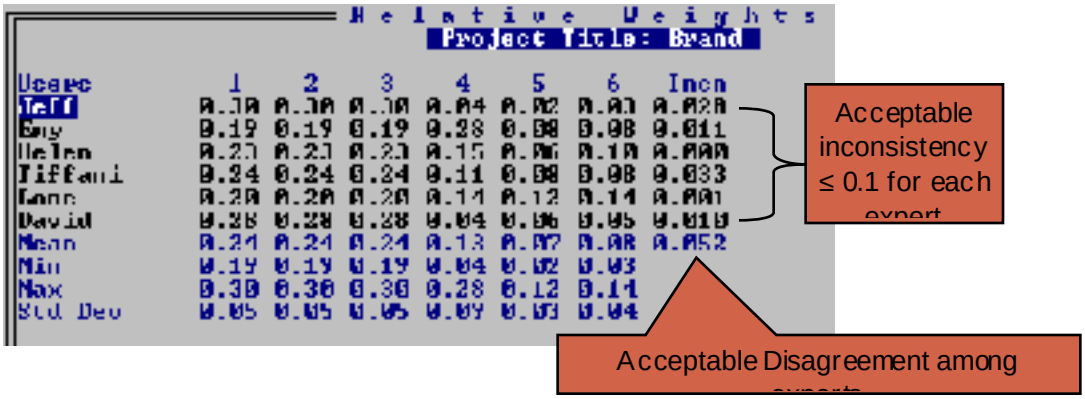
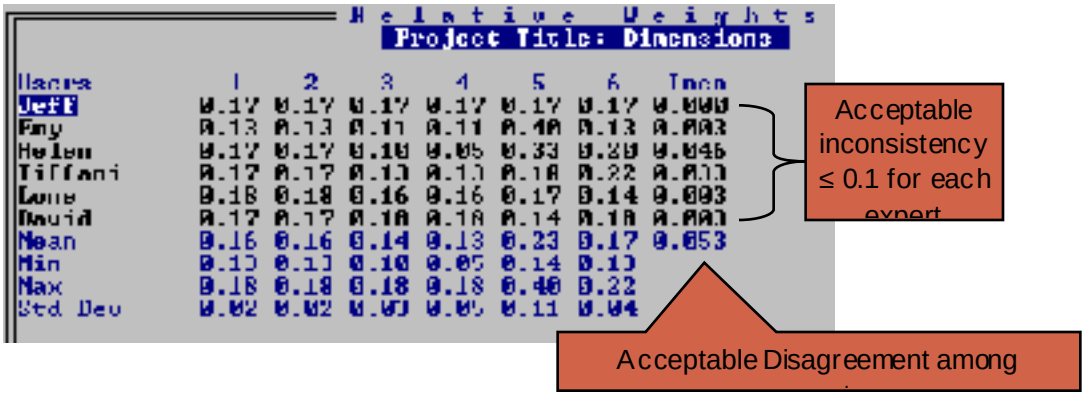
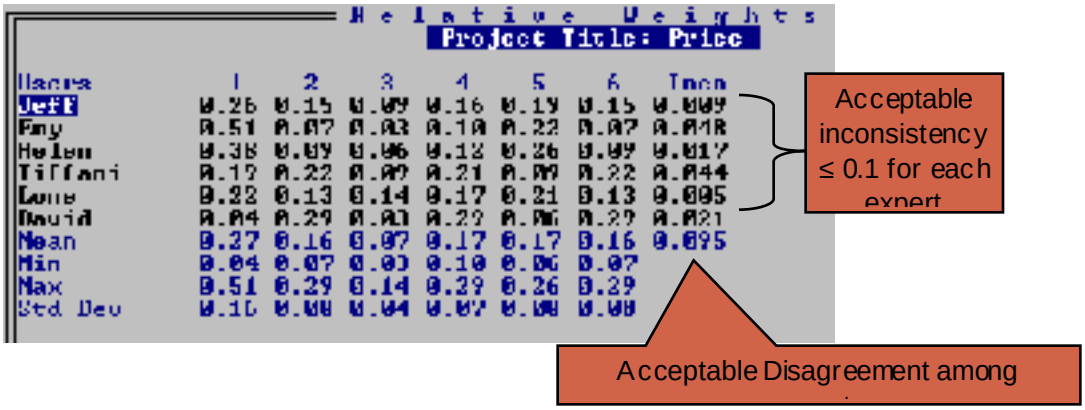
8. APPENDICES

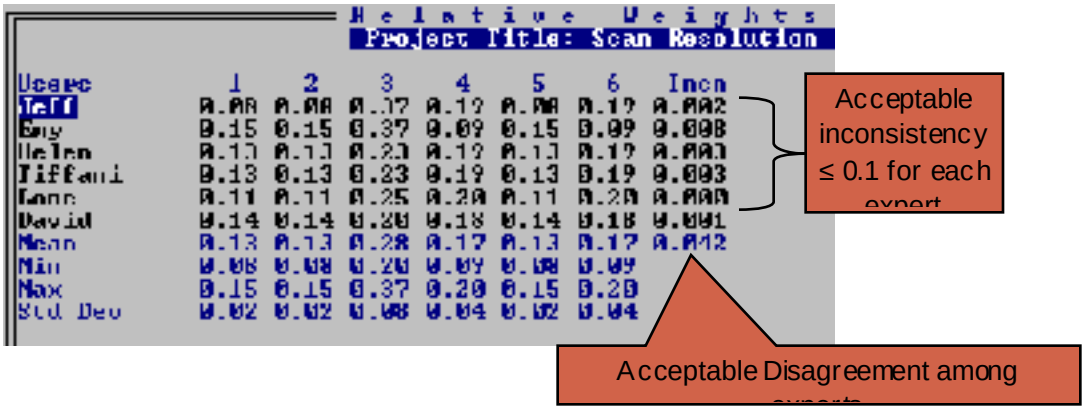
8.1 APPENDIX 1 PCM SCREEN SHOTS

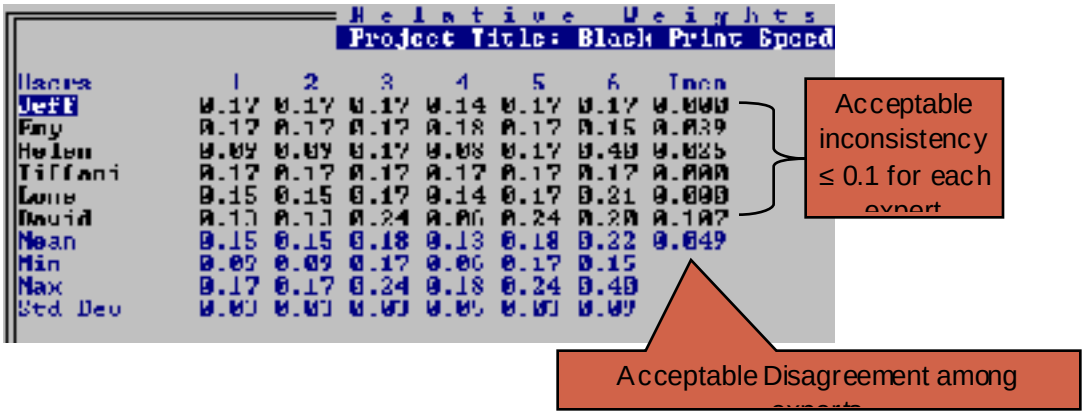


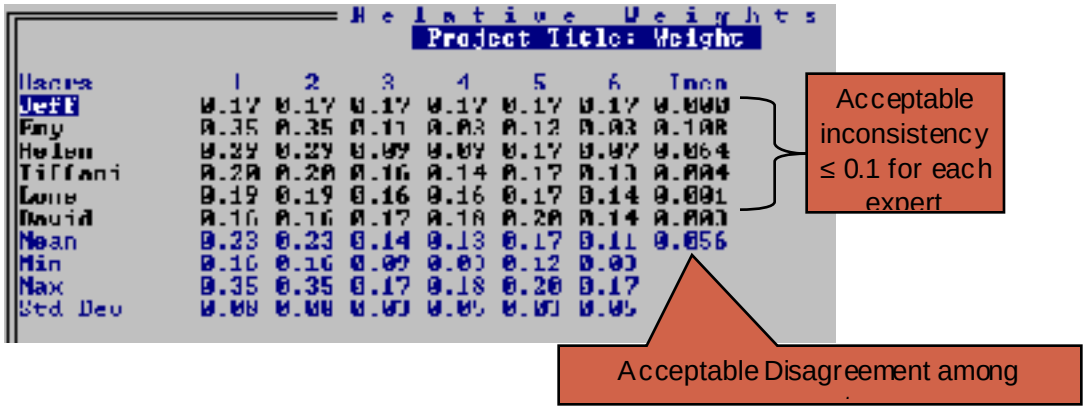





Relative Weights
Project Title: Price
Users 1 2 3 4 5 6 Incn
Jeff 0.26 0.15 0.09 0.16 0.19 0.15 0.009
Amy 0.51 0.07 0.03 0.10 0.22 0.07 0.018
Helen 0.38 0.09 0.06 0.12 0.26 0.09 0.017
Tiffani 0.12 0.22 0.09 0.21 0.09 0.22 0.044
Lorie 0.22 0.13 0.14 0.17 0.21 0.13 0.095
David 0.04 0.29 0.01 0.22 0.06 0.29 0.021
Mean 0.27 0.16 0.07 0.17 0.17 0.16 0.095
Min 0.04 0.07 0.03 0.10 0.06 0.07
Max 0.51 0.29 0.14 0.29 0.26 0.29
Std Dev 0.16 0.08 0.04 0.07 0.08 0.08
Acceptable inconsistency ≤ 0.1 for each expert
Acceptable Disagreement among


Relative Weights
Project Title: Scan Resolution
Users 1 2 3 4 5 6 Incn
Jeff 0.08 0.08 0.37 0.19 0.08 0.19 0.002
Amy 0.15 0.15 0.37 0.09 0.15 0.09 0.008
Helen 0.10 0.10 0.21 0.19 0.10 0.19 0.001
Tiffani 0.13 0.13 0.23 0.19 0.13 0.19 0.003
Lorie 0.11 0.11 0.25 0.20 0.11 0.20 0.000
David 0.14 0.14 0.20 0.18 0.14 0.18 0.001
Mean 0.13 0.13 0.28 0.17 0.13 0.17 0.012
Min 0.08 0.08 0.20 0.09 0.08 0.09
Max 0.15 0.15 0.37 0.20 0.15 0.20
Std Dev 0.02 0.02 0.08 0.04 0.02 0.04
Acceptable inconsistency ≤ 0.1 for each expert
Acceptable Disagreement among


Relative Weights
Project Title: Black Print Speed
Users 1 2 3 4 5 6 Incn
Jeff 0.17 0.17 0.17 0.14 0.17 0.17 0.000
Amy 0.17 0.17 0.17 0.18 0.17 0.15 0.039
Helen 0.09 0.09 0.17 0.08 0.17 0.40 0.025
Tiffani 0.17 0.17 0.17 0.17 0.17 0.17 0.000
Lorie 0.15 0.15 0.17 0.14 0.17 0.21 0.000
David 0.10 0.10 0.24 0.06 0.24 0.20 0.107
Mean 0.15 0.15 0.18 0.13 0.18 0.22 0.049
Min 0.09 0.09 0.17 0.06 0.17 0.15
Max 0.17 0.17 0.24 0.18 0.24 0.40
Std Dev 0.03 0.03 0.03 0.05 0.03 0.09
Acceptable inconsistency ≤ 0.1 for each expert
Acceptable Disagreement among


Relative Weights
Project Title: Weight
Name 1 2 3 4 5 6 Incon
Jeff 0.17 0.17 0.17 0.17 0.17 0.17 0.000
Amy 0.35 0.35 0.11 0.03 0.12 0.03 0.108
Helen 0.29 0.29 0.07 0.07 0.17 0.07 0.064
Tiffani 0.20 0.20 0.16 0.14 0.17 0.13 0.004
Lane 0.19 0.19 0.16 0.16 0.17 0.14 0.001
David 0.16 0.16 0.17 0.18 0.20 0.14 0.001
Mean 0.23 0.23 0.14 0.13 0.17 0.11 0.056
Min 0.16 0.16 0.07 0.03 0.12 0.03
Max 0.35 0.35 0.17 0.18 0.20 0.17
Std Dev 0.08 0.08 0.03 0.05 0.03 0.05
Acceptable inconsistency ≤ 0.1 for each expert
Acceptable Disagreement among

8.2 APPENDIX 2: DETAILED INFORMATION ON HOME PRINTERS SUGGESTED IN THE STUDY

Product Comparison	HP Photosmart C4580 All-in-One Printer, Scanner, Copier	HP Photosmart C5580 All-in-One Printer, Scanner, Copier	HP Photosmart C4599 All-in-One Printer	HP Photosmart C5280 All-in-One Printer, Scanner, Copier
				
	Add to Cart »	Add to Cart »	Add to Cart »	Add to Cart »
Your price	**$114.99*** (after rebate)	**$134.99*** (after rebate)	**$149.99***	**$179.99*** (after rebate)
HP financing	N/A	N/A	As low as $15/mo†	As low as $15/mo†
Customer reviews	Customer Ratings: 3.6 out of 5 Read 25 reviews	Customer Ratings: 4.4 out of 5 Read 28 reviews	Customer Ratings: 4.5 out of 5 Read 8 reviews	Customer Ratings: 4.4 out of 5 Read 31 reviews
Features » Highlight differences				
Functions	Color print; color copy; color scan	Color print; color copy; color scan; CD/DVD print	Color print; color copy; color scan	Color print; color copy; color scan
Black print speed	Up to 30 ppm**	Up to 34 ppm**	Up to 30 ppm**	Up to 33 ppm**
Color print speed	Up to 23 ppm**	Up to 25 ppm**	Up to 23 ppm**	Up to 31 ppm**
Black print resolution	Up to 1200 rendered dpi black (when printing from a computer)	Up to 1200 rendered dpi black (when printing from a computer)	Up to 1200 rendered dpi black (when printing from a computer)	Up to 600 x 600 dpi
Color print resolution	Up to 4800 x 1200 optimized dpi color (when printing from a computer with select HP Photo papers and 1200 input dpi)	Up to 4800 x 1200 optimized dpi color (when printing from a computer and 1200 input dpi)	Up to 4800 x 1200 optimized dpi color (when printing from a computer with select HP Photo papers and 1200 input dpi)	Up to 9600 x 2400 dpi optimized
Duplex printing	None (not supported)	None (not supported)	None (not supported)	Manual (driver support provided)
Display	1.5-in LCD (color graphics)	2.4-in LCD (color graphics)	1.5-in LCD (color graphics)	2.4-in LCD (color graphics)
Photo » Highlight differences				
Borderless printing	Yes (up to 8.5 x 11 in)	Yes (up to 8.5 x 11 in)	Yes (up to 8.5 x 11 in)	Yes (up to 8.5 x 11 in)
Direct photo printing	Yes (memory cards)	Yes (memory cards, PictBridge cameras)	Yes (memory cards)	Yes (memory cards)
Memory card support	Memory Stick, Memory Stick Duo, Secure Digital/MultiMediaCard, Secure Digital High Capacity Card, xD-Picture Card	CompactFlash, Memory Stick, Memory Stick Duo, Secure Digital/MultiMediaCard, Secure Digital High Capacity Card, xD-Picture Card	Memory Stick, Memory Stick Duo, Secure Digital/MultiMediaCard, Secure Digital High Capacity Card, xD-Picture Card	Compact Flash, Memory Stick, Memory Stick Duo, Secure Digital/MultiMediaCard, Secure Digital High Capacity Card, xD-Picture Card
Technology » Highlight differences				
Scan » Highlight differences				
Scanner resolution	Optical: Up to 1200 dpi Enhanced:	Optical: Up to 4800 dpi Enhanced:	Optical: Up to 1200 dpi Enhanced:	Optical: Up to 4800 dpi Enhanced: Up to 19200 dpi
Scanner bit depth	48-bit	48-bit	48-bit	48-bit
Maximum document scan size	ADF: Flatbed: 8.5 x 11.7 in	ADF: Flatbed: 8.5 x 11.75 in	ADF: Flatbed: 8.5 x 11.7 in	ADF: Flatbed: 8.5 x 11.7 in
Scanner input type	Flatbed	Flatbed	Flatbed	Flatbed
Copy » Highlight differences				
Copy speed	Color: Up to 23 cpm Black: Up to 30 cpm	Color: Up to 25 cpm Black: Up to 34 cpm	Color: Up to 23 cpm Black: Up to 30 cpm	Color: Up to 31 cpm Black: Up to 33 cpm
Maximum number of copies	50	Up to 50 copies	99	Up to 50 copies
Copy scaling	50 to 400%	50 to 400%	50 to 400%	50 to 400%
Paper » Highlight differences				
Supported paper sizes	Letter, legal, executive, cards, panorama, 4 x 6 inch	Letter, legal, executive, No. 10 envelopes, cards, borderless photo (4 x 6 in, 5 x 7 in, 8 x 10 in), borderless panorama (4 x 10 in, 4 x 11 in, 4 x 12 in), CD/DVD	Letter, legal, executive, cards, panorama, 4 x 6 inch	Main Tray: Letter, legal, executive, 4 x 6 in, 5 x 7 in, 8 x 10 in, No. 10 envelopes; Photo Tray: 3.5 x 5 in; 4 x 6 in; 5 x 7 in
Duty cycle	Up to 1000 pages	Up to 3000 pages	Up to 1000 pages	Up to 2500 pages
Paper handling	100-sheet input tray	125-sheet input tray, 20-sheet photo tray	100-sheet input tray	125-sheet input tray, 20-sheet photo tray
Connectivity » Highlight differences				
Networking	Standard (built-in Wi-Fi 802.11b/g)	Optional	Standard (built-in Wi-Fi 802.11b/g)	Standard (built-in Ethernet, Wi-Fi 802.11b/g)
Wireless capability	Standard, wireless 802.11g	Yes, with included Bluetooth dongle	Standard, wireless 802.11g	Yes
Connectivity	1 USB, 4 Memory card slots	1 USB 2.0, 1 PictBridge	1 USB, 4 Memory card slots	2 USB, 1 Ethernet, 1 802.11g wireless
General » Highlight differences				
Dimensions	17.09 x 11.42 x 6.38 in	17.8 x 15.24 x 8.60 in	17.09 x 11.42 x 6.38 in	17.79 x 16.57 x 8.57 in
Weight	11.16 lb	16.71 lb	11.16 lb	16.4 lb
Supported operating systems	Windows XP Home and Professional (SP1), Windows Vista(R); Mac OS X v 10.4; Mac OS X v 10.5	Windows XP Home (SP1) and Professional (SP1) (32 and 64-bit); Windows Vista (R) (32 and 64-bit); Mac OS X v 10.4; Mac OS X v 10.5	Windows XP Home and Professional (SP1), Windows Vista(R); Mac OS X v 10.4; Mac OS X v 10.5	Windows XP Home and Professional (SP1), Windows Vista(R); Mac OS X v 10.4; Mac OS X v 10.5

Artisan 700 Print | Copy | Scan | ™PictBridge | Wi-Fi® — Specifications

Printing Technology	Ultra Hi-Definition printing Advanced MicroPiezo® 6-color ink jet printing with DXD™ technology
Ink Palette	Black, Cyan, Light Cyan, Magenta, Light Magenta and Yellow
Ink Cartridge Configuration	6 individual ink cartridges
Ink Type	Claria Hi-Definition Ink (smudge, scratch, water and fade resistant photos)
Fade Resistance/Print Longevity†	Up to 200-year album storage Lasts up to 4x longer than photo lab prints
Minimum Ink Droplet Size	5 ink droplet sizes, as small as 1.5 picoliters
Maximum Print Resolution	5760 x 1440 dpi
Print Speed*	Black text up to 38 ppm Color text up to 38 ppm 4" x 6" photo in as fast as 10 seconds
Copy Speed*	Black up to 38 cpm Color up to 38 cpm
Scanner Type	Color flatbed (CIS line sensor)
Optical Resolution	2400 dpi
Maximum Resolution	9600 x 9600 dpi interpolated
Scanner Bit Depth	48-bit color
Copy Modes	Color, Black/White, Text, Graphics, Photo
Copy Quantity	Up to 99 copies (PC-free)
Maximum Copy Size	8.5" x 11.69" (PC-free)
Copy Features	Auto background removal for text, Fit to page, Reduction and enlargement (25 – 400%), Photo reprints and enlargements, Copy onto CDs/DVDs, Color restoration of old, faded photos, Scan to memory card or USB flash drive, Scan to PC, 2-sided copies with optional duplexer
Special Features	2-sided printing‡, Automatic with optional duplexer, Auto Photo Correction of digital photos with on-screen preview, Two input paper trays, Adjustable tray up to 8.5" x 14", Photo tray 4" x 6" and 5" x 7", View a photo slide show on the built-in 2.5" color LCD
PC-free Print Features	Auto Photo Correction, Select and print photos, Crop, rotate and enlarge, View and print-by-date, Print your own picture packages, Print passport and photo ID, Select multiple photos to print on a single page, Print your own school papers, college-ruled, wide-ruled and graph paper, Make personalized note paper using your own photos, Photo index sheet, Photo greeting cards
Layouts	Borderless, classic borders, photo ID, 2-up, 4-up, 8-up, 20-up, index 20-up, index 30-up, and index 80-up, picture packages, jewel index, jewel upper 1/2, lower 1/2, CD layouts (single, quarter, variety)
Color Display	2.5" LCD, Tilt control panel
Direct CD/DVD Printing	Ink jet printable CDs/DVDs
Compatible Memory Cards	SD Memory Card™ [1], SD, MiniSD™ [1], MicroSD™ [1], SDHC™ [1], Mini SDHC™ [1], Micro SDHC™ [1], Memory Stick®, Memory Stick Duo™ [1], Memory Stick PRO™ [1], Memory Stick PRO Duo™ [1], Memory Stick PRO-HG Duo™ [1], Memory Stick Micro (M2)™ [1], Memory Stick MagicGate™ [1], Compact Flash®, Compact Flash Type I™ [1], Compact Flash Type II™ [1], Microdrive®, xD-Picture Card™ [1], xD-Picture Card Type M™ [1], xD-Picture Card Type M+™ [1], xD-Picture Card Type H™ [1], MultiMedia Card™ [1], MMCplus™ [1], MMCmobile™ [1], MMCmicro™ [1], SmartMedia™ [1]
Direct Camera Connection	PictBridge™ port (cameras/phones), DPOF
Supported Digital Camera Technologies	Epson PRINT Image Matching®, Exif Print
Image Enhancement Technologies	Auto Photo Correction with advanced face detection and red-eye removal

PC-free Media Support	Plain (8.5" x 11"), Photo (4" x 6", 5" x 7", 8" x 10", 8.5" x 11", 16:9 wide), Ink jet printable CDs/DVDs
Maximum Paper Size	Plain (8.5" x 11"), Photo (4" x 6", 5" x 7", 8" x 10", 8.5" x 11", 16:9 wide), Ink jet printable CDs/DVDs
Paper Sizes	8.5" x 11", 8.5" x 14", A4, B5, A5, A6, half letter, executive, user definable (3.5" – 44" in length)
Borderless Photo Sizes	4" x 6", 5" x 7", 8" x 10", 8.5" x 11", 16:9 wide
Paper Types	Supports plain paper, Epson Bright White Paper, Photo Paper Glossy, Premium Photo Paper Glossy, Ultra Premium Photo Paper Glossy, Ultra Premium Photo Paper Luster, Premium Photo Paper Semi-gloss, Presentation Paper Matte, Premium Presentation Paper Matte and Matte Scrapbook Photo Paper (letter)
Envelope Types	No. 10, DL, C6; plain paper, bond paper, air mail
Input Paper Capacity	Main Paper Tray: 120 sheets plain paper, 10 envelopes Photo Tray: 20 sheets Premium Photo Paper Glossy
Recommended Ink Cartridges††	98 High-capacity Black, 99 Cyan, 99 Magenta, 99 Yellow 99 Light Cyan, 99 Light Magenta
Weight and Dimensions (W x D x H)	Weight: 20.5 lb Printing: 17.6" x 23.0" x 5.9" Storage: 17.6" x 15.2" x 5.9"
Case Color	Black
Connectivity	Wi-Fi 802.11 b/g, compatible with 802.11 n, Ethernet – 10/100, Hi-Speed USB 2.0, PictBridge, Bluetooth (optional)
Operating Systems	Windows Vista®, XP Professional x64, XP, 2000 Mac OS® X 10.3.9, 10.4.11 and 10.5.x (PowerPC® or Intel® processor)
Software Included	Epson printer driver, Epson Print CD, Web to Page, Epson Scan, ArcSoft® Print Creations™, Epson scanner drivers, ABBYY® FineReader®
Color Management	Auto Photo Correction and ICM
Sound Level	35 dB
Temperature	Operating: 50 ° to 95 °F (10 ° to 35 °C), Storage: 4 ° to 140 °F (-20 ° to 60 °C)
Relative Humidity	Operating: 20 – 80% Storage: 5 – 85% (no condensation)
Safety Approvals	Safety standards UL60950-1, CAN/CSA-222 No. 60950-1, EMI FCC Part 15 subpart B class B, CAN/CSA-CEI/IEC CISPR 22 class B
Power Requirements	Rated voltage: 120 VAC Rated frequency: 50 – 60 Hz Rated current: 0.8 Amp
Power Consumption	Approx. 25 W ISO 10561 Approx. 5.0 W (Sleep Mode) Approx. 0.3 W (Power Off Mode) ENERGY STAR® compliant
Warranty	2-year limited warranty and toll-free customer support with product registration*
Options	Bluetooth® photo print adapter Duplexer for 2-sided printing‡
What's In The Box	Artisan 700 photo all-in-one, setup and instruction manuals, CD-ROM with drivers and creativity software, power cord, ethernet cable (CAT-5), Epson Preferred® invitation and free 4x6 photo paper plus coupons with special offers, 6 Claria Hi-Definition ink cartridges (one 98 High-capacity Black ink cartridge and five 99 Standard-capacity color ink cartridges: Cyan, Magenta, Yellow, Light Cyan, Light Magenta)

* Pages/copies per minute (ppm/cpm) speed measured after first page, based on black and color test patterns in Draft Mode on plain paper. Color photo in Draft Mode on Premium Photo Paper Glossy measured from start of paper feed. Additional print time will vary based on system configuration, software application and page complexity. See www.epson.com/pqhg4test for more information about print speed.

‡ Double-sided printing available on the Macintosh® only with optional duplexer.

* One year limited warranty in all or some areas; toll-free support and Around your warranty require registration within 90 days of purchase. With registration, Epson provides phone support without charge for the life of the product. Telephone toll charges may apply.

† Ink fade resistance ratings based on accelerated testing of prints on specialty media, displayed indoors, under glass. Actual print stability will vary according to media, printed image, display conditions, light intensity, humidity and atmospheric conditions. Epson does not guarantee the longevity of prints. For maximum print life, display all prints under glass or properly store them. Visit www.wilhelm-research.com for the latest information.

†† Available in select areas.

†† We recommend the use of genuine Epson ink cartridges. The use of other products may affect your print quality and longevity and could result in ink ink damage. Cartridge yields vary considerably based on images printed, print settings, paper type, frequency of use and temperature. For print quality, a small amount of ink remains in the cartridge after the "replace cartridge" indicator comes on. See www.epson.com/pqhg4test for more information about cartridges.

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PIXMA MP620

Overall Rating 4.4
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Wireless Photo All-In-One Printer

Item Code: 2821B002
Suggested Retail Price: $149.99

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Specifications

Printers Attributes

Print Speed (up to)	Color Photo: 4" x 6" borderless photo: approximately 41 seconds[5] Black: Up to 28 ppm (as fast as 2.3 seconds per page)[5] Color: Up to 17 ppm (approximately 3.6 seconds per page)[5]
Number of Nozzles	Black: 320 Color: 2,048 Total:2,368
Picoliter Size (color)	1, 2 and 5
Print Resolution (up to)	Black: 600 x 600 dpi[5] Color: 9600 x 2400 dpi[5]
Output Tray Capacity	Letter, Legal, 4" x 6", 5" x 7", 8" x 10", U.S. #10 Envelopes
Automatic Sheet Feeder	150 Pages

Copier

Copy Speed (up to)	Black: Up to 24 cpm (as fast as 2.5 seconds per page)[5] Color: Up to 16 cpm (as fast as 3.8 seconds per page)[5]
Reductions Enlargement	25% - 400%
Copy Features	4 in 1 / 2 in 1, AE (Auto Exposure / Intensity Copy), Borderless, Face Brightener/ Fading Correction, Fit-to-Page, Image Repeat, Intensity, Manual Color Adjustment, Masking Copy, Multiple Copy (1-99 pages), Preset Copy Ratios, Photo Reprint, Trimming Copy, Zoom

Scanner

Scanner Element	Contact Image Sensor (CIS)
Max. Resolutions	Optical: 2400 x 4800 dpi Interpolated: 19,200 x 19,200 dpi
Scanner Features	Auto Scan Mode, Gutter Shadow Correction, Network Scan,Push Scan, Scan to Memory
Color Depth	48-bit internal/24-bit external
Max. Document Size	Flatbed: 8.5" x 11.7"

Photo Card

Support Media	SD™ Memory Card, SDHC™ MultiMedia CardCard.® (v4.1), MultiMediaCard® Plus (v.4.1),miniSD™ Card, miniSDHC™ Card, RS-MMC™ microSD™ microSDHC™ Card, Compact Flash® Card, Microdrive®, Memory Stick®, Memory Stick Pro™ Memory Stick Duo™, Memory Stick PRO Duo™, Memory Stick Micro™ , xD-Picture Card™, xD-Picture Card® (Type M), xD-Picture Card® (Type H) [2]

General Specifications

Other Features	Auto Photo Fix, Borderless Printing[9], Calendar Print, Document Printing, ID Photo Print, Photo Index Sheet, Photo Printing, Template Print
OS Compatibility	Windows Vista®, Windows XP/2000 and Mac OS®X v. 10.3.9 to 10.5x[11]
Standard Interface	Wireless LAN interface (IEEE 802.11b/g)[1], Bluetooth® v2.0[4] (Optional), Card Slots (See Memory Card Support), Ethernet, PictBridge (Cable not included), USB 2.0 Hi-Speed
Software Included	Included in box: CD-ROM including Printer Driver, Setup Software and User's Guide, Easy-PhotoPrint EX, MP Navigator EX, Solution Menu
Dimension (W x D x H)	17.8" x 14.5" x 6.9"
Weight	18.7 lbs.
Warranty	Toll-free technical phone support plus **1-year limited warranty** with InstantExchange program[12]

1. Wireless printing requires a working Ethernet network with wireless 802.11b/g capability. Wireless performance may vary based on terrain and distance between the printer and wireless network clients.
2. Compatible memory cards include SD™ Memory Card, SDHC™, MultiMediaCard® (v4.1), CompactFlash® Card, Microdrive®, Memory Stick®, Memory Stick PRO™, Memory Stick Duo™ Memory Stick PRO Duo™, and MultiMediaCard Plus (v4.1). The following can be used with the addition of a special adapter sold separately: miniSD™ Card, RS-MMC™ (v4.1), microSD™ Card, xD-Picture Card®, xD-Picture Card (Type M), xD Picture Card (Type H), miniSDHC, microSDHC, and Memory Stick Micro.
3. Requires mobile phone or other device with IrDA port and phone positioned no more than 7.9 inches from the printer.
4. Requires mobile phone (or other device) equipped with Bluetooth technology v2.0 and optional Canon Bluetooth Unit BU-30. Bluetooth operation depends on the device and software version used. Operating distance is approx. 10 meters but may vary due to obstacles, radio signals, locations where radio interference occurs, magnetic fields from microwave ovens, device sensitivity and/or antenna performance.
5. Resolution may vary based on printer driver setting. Color ink droplets can be placed with a horizontal pitch of 1/4800 of an inch at minimum.
6. Print speed measured as soon as first page beings to feed into printer and will vary depending on system configuration. Copy speed is measured after the first page is ejected. Output speed will vary depending upon a number of factors. See www.usa.canon.com/printspeed for additional details.
7. Auto Scan Mode is only available when scanning at a computer using MP Navigator EX software and selecting the 1-click feature then "save to PC".
8. Based on accelerated testing by Canon in dark storage under controlled temperature, humidity and gas conditions, simulating storage in an album with plastic sleeves. Canon cannot guarantee the longevity of prints; results may vary depending on printed image, drying time, display/storage conditions and environmental factors. See www.usa.canon.com/chromalife100plus for additional details.
9. Supported paper types for borderless printing are as follows: Photo Paper Pro II, Photo Paper Pro Platinum, Photo Paper Plus Glossy II, Photo Paper Plus Semi-gloss, Photo Paper Glossy, and Matte Photo Paper.
10. Specifications are subject to change without notice. All printed images are simulated.
11. System requirements vary by application.
12. Warranty programs are subject to certain conditions and restrictions. See www.canontechsupport.com for details.

† Prices and specifications subject to change without notice. Actual prices are determined by individual dealers and may vary.

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Compare different models

	DCP-585CW	MFC-490CW
Estimated Street Price*	$119.99	$129.99
*Street pricing may vary.	▶Where to Buy	▶Where to Buy

Key Features Overview | Full Features List

Print		back to top
Print Technology	Color Inkjet Technology	Color Inkjet Technology
Max. Black Print Speed (ppm)	33ppm Black*	33ppm Black*
Max. Color Print Speed (ppm)	27ppm Color*	27ppm Color*
Print Resolution (maximum dpi)	Up to 6000 x 1200 dpi*	Up to 6000 x 1200 dpi*
Standard Input Paper Capacity (sheets)†	Up to 100-Sheet Input Capacity and up to 20-Sheet 4" x 6" Photo Bypass Tray	Up to 100-Sheet Input Capacity; up to 20-sheet 4x6 Photo Bypass Tray
Standard Memory (MB)	40MB Memory	40MB Memory
Standard Interface(s) †	Hi-Speed USB 2.0, PictBridge Interface and USB Flash Memory	Hi-Speed USB 2.0, Ethernet, Wireless (802.11b/g),PictBridge Interfaces Media Card Slots and USB Flash Memory
Fax		back to top
Fax Modem Speed	N/A	Hi-Speed Super G3 33.6K bps Fax Modem
Telephone Handset	N/A	No
PC Fax Capability (send/receive)†	N/A	Yes
Fax Page Memory (Brother Test Chart #1)†	N/A	Up to 480 Page Fax Memory
Message Center®	N/A	No
Copy		back to top
Copying Capability	B/W & Color Copying	B/W & Color Copying
Design Style	Flatbed	Flatbed
Max. Automatic Document Feeder Capacity†	N/A	15-Sheet ADF
Max. Black Copy Speed (cpm)	22cpm Black	22cpm Black*
Max. Color Copy Speed (cpm)	20cpm Color	20cpm Color*
Reduction/Enlargement	25% - 400%	25% - 400%
Scan		back to top
Scanning Capability	B/W & Color Scanning	B/W & Color Scanning
Max. Interpolated Scan Resolution (dpi)†	19,200 x 19,200 dpi*	19,200 x 19,200 dpi*
Optical Scan Resolution (dpi)	1200 x 2400 dpi*	1200 x 2400 dpi*
Input Color Scan Bit Depth	36-Bit	36-Bit
PhotoCapture		back to top
PhotoCapture Center® Capability	Built-in Digital Media Card Drives, PictBridge Interface and USB Flash Memory Drive	Built-in Digital Media Card Drives, PictBridge Interface and USB Flash Memory Drive
Media Drive Compatibility	Compact Flash (Type 1 only), Memory Stick®/Pro®, xD-Picture Card™ Type M/H, Secure Digital™ and Multi Media Cards.	Compact Flash (Type 1 only), Memory Stick®/Pro®, xD-Picture Card™ Type M/H, Secure Digital™ and Multi Media Cards.
Other		back to top
Media Cards & USB Flash Drive not included.	X	X

*/† See the individual detail product pages for all conditions & system requirement links.