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RESP

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Araştırma Makalesi ● Research Article

Analysis Of B2B Customers' Perceptions Regarding The Quality of Tissue Paper Produced From Recycled Pulp In The Algerian Paper Industry Sector

Cezayir Kağıt Endüstrisi Sektöründe Geri Dönüştürülmüş Selülozdan Üretilen Kağıt Mendil Kalitesine İlişkin B2B Müşterilerinin Algılarının Analizi

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ANAHTAR KELİMELER

Doku Kağıdı
Geri Dönüştürülmüş Pulp
Virgin Pulp
B2B Müşteri Algısı

ÖZ

Bu makale, Cezayir kağıt endüstrisi sektöründeki dört şirket (Sarl El-Wafa Faile, Sarl Africaine Paper Mills, Faderco Group ve EPE Tonic Industries) arasında, geri dönüştürülmüş hamurdan üretilen kağıt mendil rulolarının kalitesine ilişkin B2B müşterilerinin algılarını, işlenmemiş hamurdan üretilenlerle karşılaştırarak araştırmayı ve analiz etmeyi amaçlamaktadır. Çalışma, NVivo 15 yazılımını analiz aracı olarak kullanırken, tablo formatında düzenlenmiş yapılandırılmış görüşmelerin yanı sıra yapılandırılmış görüşme protokolü ile yönlendirilen yarı yapılandırılmış görüşmelerden oluşan nitel bir metodoloji kullanmaktadır. Bulgular, kağıt mendil rulolarını bitmiş ürünlere dönüştürmekle uğraşan şirketlerin genellikle geri dönüştürülmüş kağıt hamurundan üretilen rulolara olumsuz bir bakış açısına sahip olduğunu ortaya koymaktadır. Ayrıca, bu şirketler, bu tercihi, bakire kağıt hamuru ürünlerinin algılanan üstün kalitesine ve dönüşüm sürecinde karşılaşılan zorlukların azalmasına bağlayarak, bakire kağıt hamurundan üretilen rulolara tercih göstermektedir.

KEYWORDS

Tissue Paper
Recycled Pulp
Virgin Pulp
B2B Customer Perceptions

ABSTRACT

This article seeks to investigate and analyze the perceptions of B2B customers regarding the quality of tissue paper rolls manufactured from recycled pulp, compared to those produced from virgin pulp, across four companies within the Algerian paper industry sector (Sarl El-Wafa Faile, Sarl Africaine Paper Mills, Faderco Group, and EPE Tonic Industries). The study employs a qualitative methodology, utilizing structured interviews organized into a grid format, as well as semi-structured interviews guided by a structured interview protocol, while employing NVivo version 15 software as an analysis tool. The findings reveal that companies engaged in transforming tissue paper rolls into finished products generally hold a negative perception of rolls made from recycled pulp. Furthermore, these companies demonstrate a preference for rolls produced from virgin pulp, attributing this preference to the perceived superior quality of virgin pulp products and the reduction of challenges encountered during the transformation process.

1. Introduction

Tissue paper is one of the most extensively utilized products in various hygiene applications in daily life, and its market continues to evolve. In light of the rising demand for these products, industries are positioned to manufacture high-quality tissue papers that satisfy customer requirements.

Numerous studies indicate that the quality of tissue papers is influenced by various factors, particularly the quality of the pulp utilized in their production ((Ismail, M. Y., et al., 2020) & (Fišerová, M., et al., 2019)). Tissue paper can be manufactured using either recycled pulp or virgin pulp ((Vieira, J.C. et al., 2022) & (Fišerová, M., et al., 2019)). Indeed, recycled fibers serve as a significant alternative source to virgin fibers ((Reitbauer, J., et al., 2023), (Kuman et al 2022), (Zambrano et al 2021), (Haile, A., et al., 2021),

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(De Assis et al 2019) & (Wang, Y., et al., 2019)). However, several studies have reported that the utilization of recycled materials influences the technical characteristics of the product, stemming from the variability in the properties of the used materials ((Andrew-Munot. M & Ibrahim. R.N, 2013) & (Candido. L & al, 2011)). This uncertainty has meant that the reintroduction of recycled materials, at the upstream of the production cycle, does not always fulfill the same functionalities as primary raw materials (Arnsperger. C, Bourg. D, 2016). Consequently, the disparity in quality or properties between virgin materials and recycled materials may subsequently impact the quality of the finished products. This, in turn, could influence the quality perceptions among industrial customers (B2B customers), as the characteristics of the product are the primary factors that govern B2B transactions (Chumpitaz, R., & Swaen, V., 2004). Conversely, other studies have asserted that the incorporation of minimal proportions of recycled materials does not significantly affect the quality of the resulting products ((Keskisaari. A & Kadri. T, 2018), (Mehat. N.M & Kamaruddin. S, 2011), (Sadat-Shojai. M & Bakhshandeh. G.R, 2011) & (Balart, R., et al., 2006)).

These contradictory findings are also evident in studies focused on tissue paper. A subset of research confirms that the recycling process does not alter the morphology and quality of the fibers, therefore the quality of the tissue paper produced from these fibers is maintained ((Fišerová, M., et al., 2019) & (Hubbe, M. A., Venditti, R. A., & Rojas, O. J., 2007)). On the other hand, the second group of studies supports the notion that the quality of recycled fibers deteriorates with each recycling cycle, which adversely impacts the quality of tissue paper ((De Assis et al 2018), (Raunio, J. P., Löyttyniemi, T., & Ritala, R, 2018) & (Ali, I., 2012, p.212)). This degradation creates several challenges during the transformation of tissue paper rolls into finished products (Vieira, J. C., et al., 2022). This is why industrial companies favor the use of virgin materials to ensure the production of high-quality products ((Haghighatnejad. N & al 2016) & (Sadat-Shojai. M, & Bakhshandeh. G.R, 2011)).

The discrepancies in the findings of previous studies concerning the evaluation of the quality of products made from recycled materials, coupled with the limited research in this area, prompt us to investigate the perceptions of industrial customers (B2B customers) regarding the quality of tissue paper rolls produced from recycled pulp in comparison to those made from virgin pulp. This exploration will be conducted through directive and semi-directive interviews with production and quality managers of industrial companies specializing in the transformation of tissue paper rolls into finished products, such as napkin paper, facial tissue paper, paper towels, and toilet paper. The structured interviews are designed to gather precise and quantifiable perceptions of the quality of tissue paper rolls produced from both recycled and virgin pulp, utilizing a grid based on tissue paper characteristics. Meanwhile, the semi-structured interviews aim to elucidate and analyze the scores obtained from the structured interview grid.

2. Literature Review

Tissue paper is composed of cellulose fibers derived from either virgin fibers (virgin papers) or recycled fibers (recycled papers) ((Ogbonna, U., & Aguh, P., 2024), (Vieira, J. C., Fiadeiro, P. T., & Costa, A. P., 2023), (Vieira, J.C. et al., 2022), (Fišerová, M., et al., 2019) & (Bajpai, P., 2013)). Tissue paper rolls are converted into a variety of products utilized in numerous hygiene applications in everyday life. These applications include hygienic paper, facial tissues, paper napkins, and paper towels ((Kumar, R., et al.,2022), (Prinz, M., Zollner-Croll, H., & Wölfle, C. 2020) & (Masternak-Janus, A., & Rybaczewska-Błażejowska, M., 2015)), with napkins and facial tissues being produced as folded papers, while hygienic paper and paper towels are manufactured as rolled papers (Vieira, J. C., Fiadeiro, P. T., & Costa, A. P., 2023).

These papers must exhibit favorable characteristics such as softness, water absorption capacity, strength, thickness, grammage, and elongation ((Kumar, R., et al.,2022), (Vieira, J.C. et al., 2022), (Sinta, D., Azizah, F. N., & Nugraha, B., 2021), (Prinz, M., et al., 2021), (Prinz, M., Zollner-Croll, H., & Wölfle, C. 2020), (De Assis, T., et al., 2018), (Hollmark, H., & Ampulski, R. S., 2004) & (Foelkel, C., 1998)). These attributes represent the most sought-after properties for converting manufacturers ((Vieira, J.C. et al., 2022), (Morais, F. P., & Curto, J. M., 2022) & (Rastogi, V. K., et al., 2017)).

These characteristics are influenced by the properties of the fibers used in pulp preparation, as well as the chemicals incorporated during the production process and the technology employed ((Dias, A.C., et al.,2024), (Kumar, R., et al.,2022), (Vieira, J.C. et al., 2022), (Zambrano et al.2020), (Prinz, M., Zollner-Croll, H., & Wölfle, C. 2020), (De Oliveira Mendes, A., et al., 2020), (Morais, F. P., et al., 2019), (De Assis et al.2019), (Raunio, J. P., Löyttyniemi, T., & Ritala, R., 2018) & (Rastogi, V. K., et al., 2017)).

Indeed, numerous studies have established a strong correlation between the quality of the pulp and the quality of the resulting paper. Some research indicates that the incorporation of recycled fibers adversely affects the properties of tissue paper. For instance, recycled fibers exhibit lower flexibility in the wet state compared to virgin fibers ((De Assis, T., et al., 2019) & (De Assis, T., et al., 2018)). Consequently, tissue papers made from recycled fibers demonstrate reduced strength and softness, along with diminished inter-fiber bonding capacity ((De Assis, T., et al., 2019) & (De Assis, T., et al., 2018)). Furthermore, recycled pulp predominantly consists of short fibers due to multiple recycling cycles, and contains impurities that negatively impact the properties and quality of tissue paper (De Assis, T. et al., 2019), particularly in terms of water absorption, softness, and strength (Raunio, J.P., Löyttyniemi, T., & Ritala, R., 2018). As a result, economically-oriented tissue papers are typically produced

with a high percentage of recycled material, while high-quality papers are manufactured with a greater proportion of virgin fibers (Kumar, R. et al., 2022).

However, other studies challenge the findings of the previously mentioned research by asserting that the use of recycled pulp can enhance the properties of tissue paper, thereby improving its overall quality, particularly with respect to strength ((Debnath, M., et al.,2021), (Zambrano, F., et al., 2022)). Furthermore, the rigidity of recycled fibers contributes to the formation of a thicker fiber sheet, which may provide increased volume and water absorption capacity (Hubbe, M. A., Venditti, R. A., & Rojas, O. J., 2007). Additionally, other research indicates that the incorporation of recycled pulp can enhance the whiteness of tissue paper (Fišerová, M., et al., 2019).

The motivation for our article stems from the examination and analysis of industrial customers' perceptions regarding the quality of tissue paper rolls. Previous studies have predominantly concentrated on the differences in technical quality and characteristics between tissue papers produced from recycled pulp and those made from virgin pulp, while overlooking the converters' perceptions of these products' quality. Furthermore, the contradictory findings in earlier research concerning the quality of tissue paper also prompt this investigation.

3. Research Methodology

In conducting this exploratory study, a qualitative methodology was employed, utilizing both structured and semi-structured interviews. The interview serves as a data collection method in which one individual (the interviewer) poses questions to another individual (the interviewee) (Teddlie C., Tashakkori A., 2009, p.291).

The purpose of the structured interviews, designed in the form of a grid, is to accurately evaluate industrial customers' perceptions of the quality of tissue paper rolls produced from both recycled and virgin pulp. This assessment is based on technical quality criteria derived from the literature review and utilizes a scale ranging from 1 to 4 ([1] = "low", [2] = "medium", [3] = "high", and [4] = "very high"). Subsequently, to gain a deeper understanding of the reasons behind these evaluations and to analyze the scores obtained from the responses of the interviewed managers, semi-structured interviews were conducted, in accordance with Brancati's recommendations, which indicate that this interview format facilitates the collection of in-depth information (Brancati, D., 2018, p. 139).

In this context, we conducted interviews with quality and production managers from four companies in the paper industry: Sarl El-Wafa Faile, Sarl Africaine Paper Mills (APM), Faderco Group, and EPE Tonic Industries. We specifically selected quality and production managers for these interviews, as they are directly engaged in the production process and quality assessment of the products. Consequently, it is anticipated that they possess accurate and comprehensive insights regarding the quality of tissue paper. Each interview lasted, on average, between 30 and 45 minutes.

For the analysis of the structured interviews, we chose to calculate the scores assigned by each manager to each characteristic for both types of paper. Subsequently, these scores were represented in the form of a radar chart to facilitate analysis and interpretation. For the analysis of the semi-structured interviews, we utilized the content analysis method, which encompasses transcription, coding, and data processing (Andréani, J. C., & Conchon, F., 2005). Initially, we transcribed the interviews, noting that they were not recorded in accordance with the interviewees' request for confidentiality. We then proceeded with coding and processing the transcribed data using NVivo version 15 software. Finally, we presented and interpreted the results. To achieve this, we employed NVivo 15 software to calculate word frequency, which is illustrated in the word clouds included in this article, focusing on the 50 most frequently used words after excluding irrelevant terms. It is important to note that the limited number of words is attributable either to the removal of irrelevant terms or to the constrained responses of the interviewees.

4. Analysis and Discussion of the Results

4.1. Analysis and Discussion of the Results From the Structured Interviews

The structured interviews conducted with production and quality managers from the paper processing companies (Sarl El-Wafa Faile, Sarl Africaine Paper Mills (APM), Faderco Group, and EPE Tonic Industries) regarding their assessment of the quality of tissue paper rolls produced from recycled and virgin pulp yielded the following results (see Table 1 and Table 2): Table 1 and 2 are in the Annex.

To elucidate the results obtained, the scores have been represented in the form of a radar chart (see Figure 1.).

Source: Elaborated by the author.

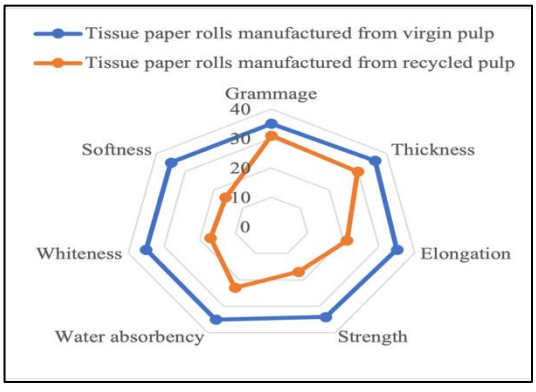

Figure 1. Presentation of the Scores Obtained From the Evaluation of the Quality of Tissue Paper Rolls Produced From Virgin Pulp and Recycled Pulp

Based on the scores obtained and presented in the radar chart above, it can be concluded that the overall characteristics (grammage, thickness, elongation, softness, strength, and water absorbency) of tissue paper rolls produced from virgin pulp are superior to those produced from recycled pulp. However, the characteristics of grammage and thickness are nearly identical for both types of paper. This finding is consistent with the study by Hubbe et al. (2007), Debnath et al. (2021) and Zambrano et al (2022), which indicated that the use of recycled pulp can achieve satisfactory thickness and volume. Similarly, the results regarding the strength and softness of the two types of paper align with the findings of De Assis et al. (2019) and De Assis et al. (2018). Conversely, the assessment of the whiteness of tissue paper made from virgin pulp reveals significantly higher values compared to that of tissue paper produced from recycled pulp, which contradicts the findings of Fišerová et al. (2019), who confirmed that the use of recycled pulp enhances the whiteness of tissue paper.

To analyze the nature of these managers' perceptions regarding the quality of tissue paper rolls produced from recycled pulp, we conducted semi-structured interviews with them. The results are presented in the following sub-section.

4.2. Analysis and Discussion of the Results From the Semi-structured Interviews

We concentrated on the evaluation of quality by consistently comparing it with the quality of tissue paper rolls produced from virgin pulp, specifically in terms of selection, quality assessment, and shaping challenges. In accordance with the recommendations of Andreani and Conchon, we organized the themes from the interviews into distinct categories (see Table 3.).

Table 3. Themes and Analysis Categories Pertaining to B2B Customers' Perception of the Quality of Tissue Paper Rolls Produced From Recycled Pulp

Themes pertaining to B2B customers' perception of the quality of tissue paper rolls produced from recycled pulp	**Analytical Categories**
1. Tissue paper rolls	• Priority in selecting tissue paper
2. Quality of tissue paper rolls	• Perception of the quality of tissue paper rolls • Quality defects in tissue paper
3. Transformation of tissue paper rolls made from recycled pulp	• Challenges in shaping tissue paper rolls into finished products

Source: Elaborated by the author.

Following the categorization of themes, we performed a thematic analysis using NVivo 15 software to calculate the word frequency for each respective category.

•**Theme 1 - Category 1:** Priority in the Selection of Tissue Paper

After posing the question, « If given the option between tissue paper rolls produced from virgin pulp and those manufactured from recycled pulp, which option would you select? », we generated the following word cloud based on the interviewees' responses (see Figure 2.):

Source: Output from NVivo version 15.

Figure 2. Word Cloud Visualizing the Priorities for Selecting Tissue Paper

Terms such as tissue, rolls, virgin, paper, among others, constitute the majority of the words utilized in the interviewees' responses, indicating a clear preference among all participants for tissue paper produced from virgin pulp as their primary choice. The following excerpts further corroborate these findings:

« … We unequivocally opt for tissue rolls made from virgin pulp » [Excerpt 1, production manager-EPE Tonic Industries].

« … It is noteworthy that tissue paper derived from virgin pulp typically exhibits superior characteristics compared to that made from recycled pulp… » [Excerpt 2, production manager- Sarl El-Wafa Faile].

« When presented with the option of selecting tissue paper rolls manufactured from virgin pulp versus those produced from recycled pulp, we unequivocally prefer tissue paper rolls made from virgin pulp…The quality of these rolls is significantly superior and cannot be matched by those made from recycled materials» [Excerpt 3, production manager-Faderco Group].

This supports the findings of previous studies indicating that industrial companies continue to favor products made from virgin materials, particularly as noted by Haghighatnejad et al. (2016) and Sadat-Shojai & Bakhshandeh (2011).

This finding can also corroborate the results of the studies conducted by Andrew-Munot and Ibrahim (2013) and Candido et al. (2011), which emphasized that the use of recycled materials adversely affects the technical characteristics of the resulting products.

•**Theme 2 - Category 1:** Quality of Tissue Paper Rolls

Question: « How do you perceive the quality of tissue paper rolls produced from recycled pulp compared to those produced from virgin pulp? »

The analysis of the interviews indicates that the interviewees emphasized specific terms, including "recycled, quality, tissue, impurities, inferior, tearing" (see Figure 3.). This suggests that the quality of tissue paper rolls produced from recycled pulp is perceived to be inferior compared to those made from virgin pulp.

Source: Output from NVivo version 15.

Figure 3. Word Cloud Visualizing the Perception of the Quality of Tissue Paper Rolls Made from Recycled Pulp

Indeed, all interviewees expressed a negative perception of the quality of tissue paper rolls produced from recycled pulp. They also referenced the quality of tissue paper rolls made from virgin pulp as a basis for comparison:

The quality manager of Sarl APM stated that « … The quality of tissue sheets produced from recycled pulp compared to those produced from virgin pulp is generally regarded as inferior » **[Excerpt 1]. The quality manager 1- EPE Tonic Industries** added that « In comparison to tissue rolls made from virgin pulp, those produced from recycled pulp are less effective, prone to tearing, and exhibit reduced absorption capacity… tissue rolls made from recycled pulp are regarded as being of inferior quality » **[Excerpt 2]. The managers of Sarl El-Wafa Faile and the Faderco Group** also confirmed that « The quality characteristics of tissue papers derived from recycled pulp are inferior to those produced from virgin pulp… » **[Excerpt 3, production manager-Groupe Faderco]**, and that « …the quality of tissue paper manufactured from recycled pulp is inferior » **[Excerpt 4, quality manager - Sarl El-Wafa Faile]**

These findings align with the conclusions of Arnsperger and Bourg's (2016) study, which asserts that the reintroduction of recycled materials into new product cycles does not consistently yield the same functionalities as those derived from primary materials. Consequently, this discrepancy is likely to impact the quality of products manufactured from these materials and influence the perceptions of industrial clients regarding their quality.

•**Theme 2 - Category 2:** Quality of Tissue Paper Rolls

Question: « What quality defects have you noticed in the tissue paper rolls produced from recycled pulp compared to those produced from virgin pulp? »

The word cloud associated with the inquiry in the category of quality defects of tissue paper rolls made from recycled pulp comprises a range of terms, including "quality, recycled, defects, paper, holes, strength, whiteness, stains, grains, thickness, inferior, irregularities, shrinkage, breaking" among others (see Figure 4.). This collection of terms indicates the presence of various quality defects in tissue paper rolls produced from recycled pulp, particularly concerning discrepancies in color, strength, density, and the occurrence of holes.

Source: Output from NVivo version 15.

Figure 4. Word Cloud Visualizing the Defects ın The Quality of Tissue Paper Made from Recycled Pulp

The recurring defects identified in the employees' responses include the following: « … the quality defects noted in tissue rolls made from recycled pulp compared to those made from virgin pulp include a decline in whiteness, the presence of stains and holes, and diminished strength of the paper » **[Excerpt 1, production manager-EPE Tonic Industries]**. Additionally, **the quality manager of Sarl El-Wafa** Faile noted that the quality defects frequently associated with tissue paper rolls produced from recycled pulp include: « … insufficient mechanical strength, the presence of significant impurities or residual inks, and inconsistencies in the quality of recycled materials. These issues can result in visible irregularities in the final product, such as spots or areas with varying density » **[Excerpt 2].** These issues can lead to visible irregularities in the final product, such as spots or areas with varying density. **The production manager of the Sarl APM** further cited defects including: « …the presence of impurities such as dust and wood, inadequate strength, poor roll formation, the occurrence of grains and holes, and sheet shrinkage » **[Excerpt 3]**.

In addition to the non-conformities of tissue papers identified in previous studies, such as reduced resistance, the officials also highlighted issues related to the presence of holes, stains, grains, and sheet shrinkage.

This is consistent with the findings of De Assis et al. (2018) and Raunio et al. (2018), which demonstrated that the

quality of tissue paper declines when produced using recycled fibers.

•**Theme 3 - Category 1:** The Transformation of Tissue Paper Rolls Made from Recycled Pulp

Question: « What are the primary challenges encountered during the process of converting tissue paper rolls made from recycled pulp into finished products, such as facial tissue, toilet paper, paper towels, and napkins, in comparison to those produced from virgin pulp?»

Based on the word cloud presented below (see Figure 5.), the challenges associated with shaping tissue paper rolls produced from recycled pulp into products such as paper towels, toilet paper, and facial tissues primarily stem from production interruptions caused by insufficient strength and sheet tearing.

Source: Output from NVivo version 15.

Figure 5. Word Cloud Visualizing the Shaping Obstacles of Tissue Paper Rolls Produced from Recycled Pulp ınto Finished Products

According to the **quality manager of Sarl APM**, several challenges arise during the production of finished products (such as facial tissue, toilet paper, paper towels, and napkins) from tissue paper made from recycled pulp. These challenges can be summarized as follows: « …the tearing of tissue sheets during various stages of the converting process, attributable to the inadequate strength of these sheets…the difficulty in addressing the issue of tissue sheet tearing during the production of different types of paper, which can hinder the ability to resume production effectively» **[Excerpt 1]**.

The managers of Sarl El-Wafa Faile and Faderco Group also noted similar concerns:

« … The presence of non-conformities, including holes, dust, and white spots, presents multiple challenges in the production process. These issues can result in paper breakage during machine processing (dry state resistance), as the holes increase the likelihood of breakage. Additionally, these non-conformities complicate the mastery of the production process, leading to inadequate embossing, disruptions in the separation lines, and suboptimal inking of designs on the paper ». **[Excerpt 2, production manager- Faderco Group]**

« The rigidity of the fiber suspension associated with recycled pulp compared to virgin pulp presents numerous challenges during the shaping process, particularly in cutting, folding, or winding operations. Additionally, tissue paper produced from recycled pulp contains shorter, less resilient, and more fragile fibers due to multiple recycling cycles… This issue complicates the formation of a solid and homogeneous paper structure, thereby increasing the likelihood of tearing, creasing, or breaking during shaping… Furthermore, the low mechanical strength of recycled pulp tissue paper can lead to breakage during unwinding, shaping, or rewinding. The dust generated from recycled materials may also obstruct cutting, folding, or packaging systems… ». **[Excerpt 3, quality manager- Sarl El-Wafa Faile]**

The results of these interviews indicate that all the companies have a negative perception of tissue paper rolls produced from recycled pulp. This type of paper exhibits several defects, resulting in numerous challenges during the transformation of the rolls into finished products. These issues may also adversely affect the quality of the final products, including hygienic paper, facial tissues, paper napkins, and paper towels.

These results align with the findings of Vieira et al. (2022), who identified several challenges associated with the use of recycled pulp in the production of tissue paper, particularly during the processing of the rolls into finished products.

5. Conclusions

This study aimed to investigate and analyze the perceptions of B2B customers responsible for transforming tissue paper rolls into finished products within the Algerian paper industry. Notably, no prior research has been conducted on this topic. Previous studies have primarily focused on assessing the quality of tissue paper rolls, whether produced from recycled or virgin pulp, while evaluating their characteristics from a technical standpoint.

The findings from the two types of interviews, directive and semi-directive, confirm that the quality of tissue paper rolls produced from recycled pulp is consistently inferior to that of those made from virgin pulp, despite a similarity in grammage and thickness characteristics between the two types of paper. This aligns with the conclusions of earlier studies, which indicated that the use of recycled pulp contributes to the degradation of the quality and characteristics of tissue paper.

Furthermore, tissue paper rolls produced from recycled pulp exhibit numerous quality defects or non-conformities, including reduced strength and whiteness, as well as the presence of stains and grains. These defects result in various challenges during shaping processes, such as production interruptions, which further explain the negative perceptions expressed by the interviewed company managers.

This study, while offering valuable insights into B2B customers' perceptions regarding the quality of tissue paper rolls produced from recycled pulp in the Algerian paper industry, it presents certain limitations that should be acknowledged. First, the study's qualitative design, based on structured and semi-structured interviews, prioritized depth of understanding over statistical representativeness. Consequently, the results mainly reflect subjective perceptions rather than quantifiable relationships between fiber origin and product quality. Moreover, the absence of complementary laboratory analyses, such as mechanical strength testing or whiteness index measurements, constitutes another limitation, as the study relied exclusively on perceived rather than objectively measured quality indicators. Finally, the geographical focus on Algerian B2B customers may restrict the external validity of the conclusions, given that perceptions of recycled materials can vary significantly across markets depending on technological, cultural, and environmental factors.

In light of these limitations, several avenues for future research can be proposed. Future studies could adopt a mixed-methods approach by integrating qualitative interviews with quantitative analyses or laboratory testing to obtain a more comprehensive assessment of tissue paper quality. Expanding the scope of research to include a larger number of firms, internationally firms particularly, would allow for comparative analyses of industrial perceptions and practices across different contexts. Additionally, investigating consumer (B2C) perceptions could provide complementary insights into how end-users value tissue paper products derived from recycled materials, particularly in relation to environmental awareness and brand image. Further studies could also focus on technological innovations in recycling and pulp treatment processes that enhance fiber quality and reduce the performance gap between recycled and virgin pulp.

References

Ali, I. (2012). Study of the mechanical behavior of recycled fibers. Applications to papers and paperboards (Doctoral dissertation, Université de Grenoble).

Andréani, J. C., & Conchon, F. (2005). Fiabilité et validité des enquêtes qualitatives. Un état de l'art en marketing. *Revue française du marketing*, (201).

Andrew-Munot, M., & Ibrahim, R. N. (2013). Remanufacturing process and its challenges. *Journal of Mechanical Engineering and Sciences*, 4, 488-495.

Arnsperger, C., & Bourg, D. (2016). Vers une économie authentiquement circulaire. *Revue de l'OFCE*, 145(1), 91-125.

Bajpai, P. (2013). Recycling and Deinking of Recovered Paper. In Recycling and Deinking of Recovered

Balart, R., et al. (2006). Kinetic analysis of thermal degradation of recycled polycarbonate/acrylonitrile–butadiene–styrene mixtures from waste electric and electronic equipment. *Polymer Degradation and Stability*, 91(3), 527-534.

Brancati, D. (2018). *Social scientific research*. Sage publications.

Cândido, L., et al. The recycling cycle of materials as a design project tool. *Journal of Cleaner Production*, 19(13), 1438-1445.

Chumpitaz, R., & Swaen, V. (2004). La qualité perçue comme déterminant de la satisfaction des clients en business-to-business. Une étude empirique dans le domaine de la téléphonie. *Recherche et Applications en Marketing (French Edition)*, 19(2), 1-22.

De Assis, T., et al. (2018). Understanding the effect of machine technology and cellulosic fibers on tissue properties – A review. *BioResources* 13(2), 4593-4629.

De Assis, T., et al. (2018). Performance and Sustainability vs. the Shelf Price of Tissue Paper Kitchen Towels. *BioResources*, 13(3).

De Assis, T., et al. (2019). Comparison of Wood and Non-Wood Market Pulps for Tissue Paper Application. *BioResources*, 14(3).

De Oliveira Mendes, A., et al. (2020). Influence of tissue paper converting conditions on finished product softness. *BioResources*, 15(3), 7178.

Debnath, M., et al. (2021). Soft mechanical treatments of recycled fibers using a high-shear homogenizer for tissue and hygiene products. *Cellulose*, 28(12), 7981-7994.

Dias, A. C., et al. (2024). Environmental Sustainability Assessment of Tissue Paper Production. *Sustainability*, 16(21), 9419.

Fišerová, M., et al. (2019). Influence of bleached softwood and hardwood kraft pulps on tissue paper properties. Cell. Chem. *Technol*, 53(5-6), 469-477.

Foelkel, C. (1998). Eucalypt wood and pulp quality requirements oriented to the manufacture of tissue and printing & writing papers. *In APPITA 52nd Annual General Conference. Anais.*

Haghighatnejad, N., et al. (2016). Properties of recycled PVC aggregate concrete under different curing conditions. *Construction and Building Materials*, 126, 943-950.

Haile, A., et al. (2021). Pulp and paper mill wastes: utilizations and prospects for high value-added biomaterials. *Bioresources and Bioprocessing*, 8, 1-22.

Hollmark, H., & Ampulski, R. S. (2004). Measurement of tissue paper softness: A literature review. *Nordic Pulp & Paper Research Journal*, 19(3), 345-353.

Hubbe, M. A., Venditti, R. A., & Rojas, O. J. (2007). What happens to cellulosic fibers during papermaking and recycling? A review. *BioResources*, 2(4), 739-788.

Ismail, M. Y., et al. (2020). Surface analysis of tissue paper using laser scanning confocal microscopy and micro-computed topography. *Cellulose*, 27, 8989-9003.

Keskisaari, A., & Kärki, T. (2018). The use of waste materials in wood-plastic composites and their impact on the profitability of the product. *Resources, Conservation and Recycling*, 134, 257-261.

Kumar, R., et al. (2022). High-performance sustainable

tissue paper from agricultural residue: a case study on fique fibers from Colombia. *Cellulose*, 29(12), 6907-6924.

Masternak-Janus, A., & Rybaczewska-Błażejowska, M. (2015). Life cycle analysis of tissue paper manufacturing from virgin pulp or recycled waste paper. *Management and Production Engineering Review*.

Mehat, N. M., & Kamaruddin, S. (2011). Optimization of mechanical properties of recycled plastic products via optimal processing parameters using the Taguchi method. *Journal of Materials Processing Technology*, 211(12), 1989-1994.

Morais, F. P., & Curto, J. M. (2022). Challenges in computational materials modelling and simulation: A case-study to predict tissue paper properties. *Heliyon*, 8(5).

Morais, F. P., et al. (2019). Comparative characterization of eucalyptus fibers and softwood fibers for tissue papers applications. *Materials Letters: X*, 4, 100028.

Ogbonna, U., & Aguh, P. (2024). Evaluation and optimization of recycled paper quality for Tissue Paper Production with Comparative Techniques using Historical Data. A case of Anex Paper Industries. *International Journal of Industrial and Production Engineering*, 2(1), 1-16.Paper. Elsevier Inc. https://doi.org/10.1016/C2013-0-00556-7

Prinz, M., et al. (2021). A new method to evaluate the hand-feel potential of furnishes for tissue paper products. *BioResources*, 16(1), 684.

Prinz, M., Zollner-Croll, H., & Wölfle, C. (2020). Hygiene Paper Softness-New insight into the manufacturing process with an optimised tissue softness analyser. In #PLACEHOLDER_PARENT_METADATA_VALUE# (pp. DiV5-03). chemical-engineering. at.

Rastogi, V. K., et al. (2017). Dependence of softness perception on tissue physical properties and development of neural model for predicting softness. *IPPTA–The official International Journal*, 29(2), 128-135.

Raunio, J. P., Löyttyniemi, T., & Ritala, R. (2018). Online quality evaluation of tissue paper structure on new generation tissue machines. *Nordic Pulp & Paper Research Journal*, *33*(1), 133-141.

Reitbauer, J., et al. (2023). Bulk characterization of highly structured tissue paper based on 2D and 3D evaluation methods. *Cellulose*, 30(12), 7923-7938.

Sadat-Shojai, M., & Bakhshandeh, G. R. (2011). Recycling of PVC wastes. *Polymer degradation and stability*, 96(4), 404-415.

Sinta, D., Azizah, F. N., & Nugraha, B. (2021). Analisis pengaruh refiner time terhadap quality tissue (studi kasus di PT Pindo Deli Pulp and Paper Mills 2). *Angkasa: Jurnal Ilmiah Bidang Teknologi*, 13(1), 27-36.

Teddlie, C., & Tashakkori, A. (2009). *Foundations of mixed methods research: Integrating quantitative and qualitative approaches in the social and behavioral sciences*. Sage.

Vieira, J. C., et al. (2022). Embossing pressure effect on mechanical and softness properties of industrial base tissue papers with finite element method validation. *Materials*, 15(12), 4324.

Vieira, J. C., Fiadeiro, P. T., & Costa, A. P. (2023). Converting operations impact on tissue paper product properties–a review. *BioResources*, 18(1), 2303.

Wang, Y., et al. (2019). Relationship between human perception of softness and instrument measurements. *BioResources*, 14(1), 780-795.

Zambrano, F., et al. (2022). Developing alternative, high-absorbency Brown fibers: tissue paper from upcycled corrugated packaging waste to meet new consumer trends. *ACS Sustainable Chemistry & Engineering*, 10(40), 13343-13356.

Zambrano, F., et al. (2020). National brands vs. private labels: a market dynamics analysis for hygiene tissue in the United States. *Paper First Mag (Autumn Issue),* 16-20.

TABLES 1 AND 2

Table 1. Assessment of the Quality of Tissue Paper Made from Virgin Pulp

	Function	Quality criteria for tissue paper						
		Grammage	Thickness	Elongation	Strength	Water absorbency	Whiteness	Softness
Sarl El-Wafa Faile	Quality manager	4	4	4	4	4	4	4
	Production manager	3	4	4	3	4	3	4
Sarl APM	Quality manager	4	4	4	4	3	4	4
	Production manager	4	4	3	3	4	4	3
Faderco Group	Production manager	3	3	3	3	3	3	3
	Quality manager 1	3	3	3	3	3	3	3
	Quality manager 2	4	4	4	4	4	4	4
EPE Tonic industries	Production manager	3	3	3	3	3	3	3
	Quality manager 1	3	3	3	3	3	3	3
	Quality manager 2	4	4	4	4	4	4	4
Score		35	36	35	34	35	35	35

Source: Elaborated by the author.

Table 2. Assessment of the Quality of Tissue Paper Made from Recycled Pulp

	Function	Quality criteria for tissue paper						
		Grammage	Thickness	Elongation	Strength	Water absorbency	Whiteness	Softness
Sarl El-Wafa Faile	Quality manager	4	2	1	2	1	2	1
	Production manager	2	2	3	2	2	1	2
Sarl APM	Quality manager	3	4	1	1	3	1	1
	Production manager	4	4	2	2	3	2	2
Faderco Group	Production manager	3	3	2	2	2	2	2
	Quality manager 1	2	2	3	2	3	1	1
	Quality manager 2	4	4	2	1	3	3	2
EPE Tonic industries	Production manager	3	3	2	1	2	2	2
	Quality manager 1	3	3	2	2	1	2	1
	Quality manager 2	3	3	3	2	2	1	2
Score		31	30	21	17	23	17	16

Source: Elaborated by the author.