

Louis Vuitton Embraces 3D Printing taking Luxury to New Frontiers of Innovation and Technology

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Abstract

The Luxury Goods Industry is going through a drastic revolution as both clothing manufacturers and consumers have been acclimatizing to a rather new way of interaction. Manufacturers are shifting their approach towards integrating innovation into their longstanding research development and product development aligning them with consumers' demands across the globe. This paper aims at studying innovation solutions, in the form of a case study, adopted by iconic French Luxury brand Louis Vuitton (LV), which is focused on delivering luxury shopping experiences using state-of-the-art 3D Printing technology which has been emerging tremendously. 3D-printing is a popular scientific technology for creation of 3D articles by placing sequential layers of diverse constituents. Among the extensive assortment of applications, Louis Vuitton has adapted this printing model to modernize their brand products. LV has constantly been the frontrunner in manufacturing high quality, high-end merchandises that customers religiously admire. In continuation this ongoing custom, LV designers are relentlessly looking for novel and enhanced mediums of supplying these goods to the customers. The application of modern technology, to embrace desktop 3D printing, will remain to be a crucial instrument in its expedition. This study also looks at the impact of LV's first worldwide 3D printing outlet in Australia working hand-in-hand with specialist 3D print generator and how the brand is today likely to influence the usage of this 3D technology globally. The findings show that desktop 3D printing at LV has permitted scientists and producers at all of their locations to further experiment and be more creative in designing innovative and improvised fabrication techniques. New manufacturing methods applying 3D printing are effortlessly explored, executed at economic budgets to be then shared on collaborative terms with other LV manufacturing units globally, thus allowing easy transitions in fresh start-ups and manufacturing line changes as each new season approaches.

Keywords: Clothing; Global; Innovation; Louis Vuitton; Technology; 3D Printing

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1. Introduction

One of the major disadvantages of traditional manufacturing techniques is their limits and huge capital investment is needed for setup of industry (Muhmad et al., 2014). New technologies, such as 3D-printed clothing, zero-waste garments, and circularity-focused clothes, and new commercial models, such as leasing and exchanging, have revolutionised the fashion industry in the twenty-first

century (Henninger et al., 2017a; Park & Armstrong, 2017). Dynamic reactions to evolving market conditions are essential for survival. In the face of shorter product life cycles, the worldwide garment sector including the luxury market uses technological development to challenge established manufacturing techniques and speed time-to-market.

Using digital design tools like computer-aided design (CAD), computer-aided manufacturing (CAM), or other 3D modelling software, three-dimensional printing (3DP) can produce 3D objects quickly, efficiently, and layer-by-layer (MacDonald, 2016). In contrast to traditional manufacturing methods, 3D printing can generate complex three-dimensional constructs in a relatively short cycle and at a reduced cost than conventional printing methods, such as printing out a 2D pattern demonstration or picture plane (Wang, 2014). Architecture (He et al., 2020), energy (Vaghasiya et al., 2021), electronics (Asulin et al., 2021), biomedicine (Cho et al., 2021), and aerospace (Syuhada et al., 2021) are just some of the fields that have taken advantage of 3DP technology because of its high manufacturing performance, expandability, low price, and capability to deal with complexity. The 3DP method involves constructing a product by depositing material in a series of successive layers (as if coating) until the product is finished (ASTM 2019; Khajavi, Holmstrom, and Partanen 2018; Vanderploeg et al., 2017: 170). It is possible to embellish the surface of textiles with no additional adhesives when using three-dimensional printing (Chatterjee and Ghosh, 2020). According to research by Grimmelsmann et al. (2018), who examined the adhesion properties of 3D printing components on textile materials, the key reason that caused adhesion had been physical "locking" among textiles and printing materials instead of chemical bonding. Although 3DP is a promising technology, controlling its adhesion, longevity, and stability on textiles has proven challenging, thereby limiting both the textile substrates available and the polymers available for use in 3D printing (Grimmelsmann et al. 2018). Due to its flexibility in terms of size and shape, 3D printing has also garnered considerable interest in the textile and clothing industries over the past decade. In comparison to conventional clothing manufacturing, 3D

printing technology enables massively complicated frameworks to be designed and tailored to each wearer via 3D scanning (Cabigiosu, 2020). Producing goods with the same versatility, expandability, and pore structure as traditional textiles is challenging due to the scarcity of raw materials. The use of 3D printing to create textiles with added functionality has received a great deal of attention recently. By accumulating biomaterials onto textiles, 3D printing opens up new possibilities for the design of safety equipment and smart clothing without sacrificing the convenience or attractiveness of both. The potential uses for 3D printed textiles are growing.

According to a survey by the Italian luxury items producers' organization, Fondazione Altagamma, and business consulting company Bain & Company, the global luxury market is recovering quickly from the epidemic and might exceed €380 billion by 2025. 3D printing is playing an increasingly significant role in the luxury industry, especially in this expanding market. Additive manufacturing has a wide range of applications in the high-end industry, from fashion accessories and eyewear to haute couture and sports vehicle parts. The Louis Vuitton Corporation (often known as Louis Vuitton), a high-end French clothing brand, has continuously been at the forefront of generating high-quality, high-end goods that buyers seek out on a regular basis. Technological advances, like 3D desktop printing technology, are proving to be a valuable tool in the company's goal to remain among the most recognized brands in the world.

The fashion industry is just one of many that will benefit greatly from the revolutionary new 3D printing technology of the industrial revolution 4.0 (Sim 2017). According to Gartner's report, 3D printing's popularity will soar in the healthcare, transportation, and retail sectors (Basiliere 2017). Since the patents for two popular types of 3D printing—Fused Deposition Modeling (FDM) and Selective Laser Sintering (SLS)—expired in 2009 and 2014, respectively (Lee and Lee, 2016), the technology is finding new uses, including in the fashion market. Companies that produce 3D printers on a global scale, such as Stratasys and 3D Systems, are teaming up with designers to showcase unique creations. Time magazine named a 3D printed

designer dress, created by Stratasys and Iris Van Herpen, one of the 50 best inventions of 2011 (David 2012). Despite the widespread interest in and development of 3D printing technology, its application in the fashion industry has been less vigorously pursued due to material constraints, difficulties in acquiring the technology, and the fact that the product must be worn on the human body. When it comes to 3D printing technology's application in the fashion industry, there are already a number of pivotal prior studies. Other ongoing studies include ones on how to gain knowledge about 3D printing technology (Kwon et al., 2017), on the 3D printing materials used to produce textiles (Lee and Hong, 2016), work to offer novel theoretical models of adapting 3D printing technology (Sun and Zhao 2017) and on the use of 3D printing technology to develop latest ideas (Chun 2017). Most studies, however, concentrate on various manufacturing techniques (Vanderploeg et al., 2017).

The usage of 3D printing in the fashion industry is on the rise, and it has spread from the realm of haute couture (Yap & Yeong, 2014) to more accessible areas including jewellery (Shapeways, 2018a), swimwear (aRks, 2016), and footwear (Heater, 2018). Therefore, luxury market has

gained a foothold when artists and apparel manufacturers discovered the advantages of the technology. They could use it to create amazing 3D printed images of fashion ever-seen-before and also geometrical patterns, but they might also prototype. Despite the fact that designers are inventing and discovering new ways, 3D printed fashion in luxury market is still growing on a mass level.

3D printing in the world of luxury fashion is also growing rapidly for eco - fashion as more artists and organizations explore sustainable ways of producing their lines. 3D printing in fashion opens up a whole new world of possibilities when it comes to personalization. Turning movable/flexible material into garments is what 3D printing is all about. This technology is truly allowing designers a lot of leeway. The luxury fashion industry is starting to leverage the power of additive manufacturing processes and make unique products, from accessories and footwear to 3D printed garments. 3D printing offers adopters several benefits. On the contrary, despite its future implications for production, 3D printing faces a number of hurdles, as shown in Table 1 below:

Table 1: Benefits and Challenges of 3D Printing (Source: TWI Ltd., 2022)

3D PRINTING	
BENEFITS	CHALLENGES
Reduced inventory, thus low production cost	Makes product price unreasonable
Efficient Product Iteration Cycles	Lacks Long-Term Durability
Simplified Assembly	Manufacturing Jobs will decrease
Complex Geometries & 3D complex designs	Low Resolution quality
Product Customisation	Limited Raw Material
Lead Time Reduction	Not Environment Friendly
Zero Waste Production	Applicable only for smaller objects
Supply Chain Management	Maintaining copyright of products is difficult

2. Research Objective

1) To understand the impact of the merger between 3D-printing technology and the luxury market which is known for its bespoke handcrafted products.






3. Review of Literature





Louis Vuitton had stepped into the metaverse, a trend that promised to create new 3D printing opportunities for the world. For Louis Vuitton, the introduction of desktop 3D printing into the method of producing high-end, high-quality items was nothing but excellent. Furthermore

significantly, the quality of the process advances, leading to additional cost reductions due to its lower rate of failure. Designers are also encouraged to take more risks with their creations because they can immediately examine their practicality. The luxury fashion industry is undoubtedly taking full advantage of the opportunity. These instruments aid in the development of an elegant finished garment or accessory.

Louis Vuitton is one such example. Yes, the well-known name in the luxury fashion sector that uses 3D printing to create instruments that aid in the efficient and elegant production of their final items. The full catalogue for year 2021-22 is illustrated below in Table 2:

Table 2: Catalogue Inventory (Year 2021-22) (Source: louisvuitton.com)

S. No.	Item Category	SKU No	Image Source (link)	Image
1	3D POCKETS MIX NYLON TRACK PANTS	1A5WB7	https://eu.louisvuitton.com/eng-e1/products/3d-pockets-mix-nylon-track-pants-nvprod1790047v#1A5WB7	
2	3D MONOGRAM GLOVES	M76451	https://eu.louisvuitton.com/eng-e1/products/3d-monogram-gloves-nvprod2440049v	
3	MONOGRAM 3D EFFECT PRINT PACKABLE T-SHIRT	1A5WA5	https://eu.louisvuitton.com/eng-e1/products/monogram-3d-effect-print-packable-tshirt-nvprod1790045v#1A5WA5	
4	MONOGRAM REMOVABLE 3D POCKETS CARGO PANTS	1A5WCG	https://eu.louisvuitton.com/eng-e1/products/mng-removable-3d-pockets-cargo-pants-nvprod1790041v#1A5WCG	
5	3D MONOGRAM ROBE	1A9LKL	https://eu.louisvuitton.com/eng-e1/products/3d-monogram-robe-nvprod3170056v#1A9LKL	
6	DAMIER 3D SCARF	M76571	https://eu.louisvuitton.com/eng-e1/products/damier-3d-scarf-nvprod2660034v	


S. No.	Item Category	SKU No	Image Source (link)	Image
7	3D PADDED EMBROIDERED HOODIE	1A5PAR	https://eu.louisvuitton.com/eng-e1/products/3d-padded-embroidered-hoodie-nvprod1630378v#1A5PAR	
8	3D MONOGRAM TROMPE L'OEIL MINI SHORTS	1A9LKZ	https://eu.louisvuitton.com/eng-e1/products/3d-monogram-trompe-l%E2%80%99oeil-mini-shorts-nvprod3170060v#1A9LKZ	
9	3D MONOGRAM TANK TOP	1A9LKE	https://eu.louisvuitton.com/eng-e1/products/3d-monogram-tank-top-nvprod3170063v#1A9LKE	
10	CAMPUS BUMBAG	N50022	https://eu.louisvuitton.com/eng-e1/products/campus-bumbag-damier-infini-nvprod2630058v	



3.1 Louis Vuitton and Pop-up stores

A pop-up store is a provisional retail facility (also known as a "pop-up shop") to capitalise on a fad or seasonal demand. When most people think of Louis Vuitton, they probably think of leather purses with the "LV" logo on them, and not cutting-edge technology. Louis Vuitton began employing pop-up stores in 2019 to attract buyers outside of its supply chain, which saw a surge in sales within the first quarter.

Pop-up stores are important because they constitute another channel for disseminating new releases from the brand to consumers. Louis Vuitton made it feasible for them to reach clients in a variety of ways and at various locations. Unlike regular retail outlets, the pop-up store is marketed as a "limited-edition" item that customers must enjoy the benefits of right away or risk regretting their decision later. It also acts as a great strategy for test marketing in a retail setting. As can be seen in Table 3, Louis Vuitton has used pop-up stores to expand its brand and raise awareness.

Table 3: Louis Vuitton's Pop-up Stores

S. No.	Location	Collection	Product	Image Source (Link)	Image
1	Westfield Shopping Centre, Sydney (World's 1st pop up Store)	Spring /Summer 2017 collection, Safari inspired Menswear apparels, accessories, bags, watches and shoes	30 wall panels of the pop-up store were 3d printed with animal graphics matching to the safari theme in products along with furniture	https://eu.louisvuitton.com/eng-e1/lv-now/to-17	

S. No.	Location	Collection	Product	Image Source (Link)	Image
2	138, Pitt Street, Sydney, Australia	Men's Fall-Winter 2019 collection, sneakers to sunglasses, leather jackets, and topcoats	8m high sculpture of designer, Virgil Abloh was 3D printed by Louis Vuitton as a tribute	https://retaildesignblog.net/2019/07/19/louis-vuitton-pop-up-store/	
3	de Bijenkorf department store, Amsterdam	Infused with colour- Women's Summertime 2021 Capsule Collection, swimming pool inspired women's apparel, accessories, shoes	Ground pillars in a wavy bright blue substance that evokes water are coupled with a stronger 3D-printed water design on the flooring	https://eu.louisvuitton.com/en-e1/magazine/articles/hamburg-store-opening	

Westfield, Sydney: In Sydney, Australia's Westfield shopping complex, the premium retailer: Louis Vuitton has unlocked what is thought to be the first three - dimensional (3D) pop-up shop in the world. Louis Vuitton has become the first company in the world to construct a 3D-printed point-of-sale display in a shopping centre, thanks to Melbourne-based large-format 3D printing company, Omus and a handful of Massivit-1800 3D printers. The luxury brand mounted a 968 sq. ft. (9m wide, 10m long, and 2.7m) structure, which was made possible with a 3D printing machine in only 3 weeks, in collaboration with specialist 3D print provider Omus. The firm was required to provide a visually appealing and structurally sound outlet. "Given the design's intricacy and short turnaround time, 3D printing was basically the only viable production method they had." The 3D-printed roof of Louis Vuitton's dome-shaped store was coupled with elephant artworks. The dome was made up of 48 components, each of which was 3D printed, gathered and covered with "Avery Supreme Silver" packaging film to enhance all images. Despite some doubt, the team was able to pull together to 3D print all of the elements for the given structure. Many fabricators had indicated that a pop-up store couldn't be built in time using traditional methods, but large-format 3D printing made it possible.

4. Research Methodology

The research involves a case study of the French fashion house, Louis Vuitton, followed by content analysis, word

cloud analysis and sentiment analysis. The study attempts to gain a preliminary knowledge of the study's concept. Secondary sources of information will be the subject of this paper. The specific research will be carried out using current books, articles, reports, and theories specialising in Louis Vuitton and 3D printing.

Case Study- Louis Vuitton

Established in 1821

Headquarter: Paris

Collections: high-end leather goods, designer clothing and accessories, ready-to-wear products, jewellery.

Website: www.louisvuitton.com

4.1 Data Collection

This qualitative study examines participants' attitudes toward 3D-printed clothing and their propensity to buy it. Fifteen in-depth interviews were done at LV's Paris store. A survey questionnaire was prepared and distributed, followed by face-to-face interviews, which in total lasted for an average of 40 minutes. The respondents were selected using Snowball sampling which means that respondents advised others to join the study. Participants in the survey had to be between the ages of 18 and 35, and interested in new inventive luxury items enabling them to show their originality. Males and females were virtually equally represented (Refer Table 4). The Questionnaire and the Interview questions focused on 3D-printed clothing,

media stories, and consumers' impressions of luxury brands using adaptive manufacturing technologies.

4.2 Content Analysis

Following the conclusion of the survey and the interview, the data from the study was analyzed, and the results are

presented, in Table 4 below. The primary concepts were extracted and coded using NVivo 12.0. In total, 581 nodes related to 3D printing apparels, social media reels and consumer perceptions towards the use of 3D Printing by Luxury Brands, were uncovered through the responses of the participants and their observations.

Table 4: Statistical Data & Content Summary

S. No	Participant Code	Age	Gender	Field of work	Number of Nodes coded
1	UGF_18	18	Female	UG Student	54
2	EDUF_22	22	Female	Education	64
3	BUSF_24	24	Female	Business	45
4	RETF_25	25	Female	Retailing	36
5	ENGF_19	19	Female	Engineering	51
6	PGM_21	21	Male	PG Student	16
7	BUSM_23	23	Male	Business	24
8	EDUM_26	26	Male	Education	33
9	FASHM_24	24	Male	Fashion Retailing	25
10	MEDF_30	30	Female	Medicine	36
11	PHARM_27	27	Male	Pharmacy	25
12	FASHF_27	27	Female	Fashion Management	34
13	HSCM_21	21	Male	Home Science	52
14	ENTRM_23	23	Male	Entrepreneur	42
15	SCIF_23	23	Female	Science	44
				Total	581

4.3 Word Cloud Analysis

As shown in Figure 1, the 'Word Cloud' illustrates the most often used words by respondents (e.g., creative, 3D printed, fashion, technology, luxury). The study intends to examine how 3D printing affects consumer views.



Figure 1. Word Cloud Analysis

4.4 Sentiment analysis

People express sentiments and communicate their feelings regarding a situation. This relationship might be positive, neutral or negative. This study uses NVivo 12.0 to analyse qualitative data. Table 5 displays participants' attitudes towards 3D printing.

Table 5: Sentiment Analysis towards 3D Printing

S. No	Participant Code	Very Negative	Negative	Neutral	Positive	Very Positive
1	UGF_18	8	4	14	12	7
2	EDUF_22	6	7	1	13	5
3	BUSF_24	12	6	4	14	9
4	RETF_25	10	5	9	11	10
5	ENGF_19	9	4	14	8	10
6	PGM_21	4	4	9	2	6

7	BUSM_23	3	3	3	9	7
8	EDUM_26	4	1	5	4	8
9	FASHM_24	8	2	10	11	9
10	MEDF_30	4	2	8	8	10
11	PHARM_27	3	5	7	9	6
12	FASHF_27	9	6	6	8	4
13	HSCM_21	11	9	4	7	9
14	ENTRM_23	4	11	9	9	3
15	SCIF_23	3	7	9	10	7
		98	76	112	135	110

This table shows that 3D printing has a fairly favourable impact on sentiments. Positive attitude appears 245 times, neutral attitude appears 112 times while negative attitude is for 174 times.

5. Results and Discussion

5.1 Price Justification

Although 3D printing has been around since the 1980s, it has only recently become increasingly popular in the luxury industry. Should these high-end firms be afraid of 3D printing, or should they embrace it and build a new type of collaboration? Louis Vuitton needs to justify its sky-scraping prices even though its products still maintain their exclusivity and handmade appeal. To justify the prices, one must consider the heritage, workmanship, and materials used in the creation of these high-end items. Luxury consumers appreciate the artists' meticulous attention to detail, which, in their opinion, justifies the exorbitant prices associated with the products. Although these products are raising eyebrows on the very foundation of the luxury brand that symbolised bespoke hand crafted overpriced customisable products, its latest offering comes in stark contrast to its founder's mission/vision. Therefore, Louis Vuitton aims at creating bespoke handcrafted 3d printed products that are yet again exclusive and expensive.

5.2 Marketing Strategies

The Marketing Strategies of Louis Vuitton have gone through a drastic realignment especially on account of the

digitalization of manufacturing processes. One such example is evident from Louis Vuitton's new range of 3D products launched worldwide with creation of awareness driven through pop-up stores in global locations. Organizations are hopping on board now to prepare for the future while also gauging client engagement. Luxury brands have been able to speed innovation and offer solutions that were previously impossible to achieve due to the limitations of traditional manufacturing techniques." 3D printing has altered the way consumers interact with brands by combining creative thinking and consumer experience to provide unprecedented levels of personalisation and co-creation. 3D printing exemplifies the merging of real and digital worlds.

5.3 New Customer Segmentation

In the new digital world, Louis Vuitton wants its presence within youth cultures that dominate the market. Louis Vuitton also wants experimentation by entering the Avant Garde market, something it has never done before. From accessories, eyewear, footwear, to moulding and internal structures, 3D printing has a lot to offer to a sector such as luxury. 3D printing accelerates the design process and enables on-demand production with durable materials and a quality finish. Top luxury brands are now making the

most of 3D printing for prototyping, small series and mass-production. More complex and personalized parts can be made to satisfy the most demanding customers.

5.4 Key Observations - Louis Vuitton will continue to manufacture handcrafted, customized merchandise made on demand, while at the same time use 3D printing to create radical new designs for both casual and formal occasions.

- Patrons around the world are sceptical about LV's 3D printing venture, which they also term as additive manufacturing, has the potential to democratize the production of fine bespoke pieces.

- LV's experimental venture with 3D printers, could possibly propel the brand and hoist it to a new level of market segmentation based on youth culture and Gen Z.

6. Conclusion and Scope

Evolution of 3D printing has produced a drastic upheaval in LV's marketplace. LV has discovered 3D printing as a way of connecting with and engage its fans. Think, Manufacture and Distribute has always been the conventional path luxury fashion business has been pursuing for decades, thereby minimizing the amount of inventory and also avoid stockpiles from past few seasons. Brands can sell their goods with regular 3D visuals that could be uploaded to their website. 3D would also allow and facilitate the creation of digital products. 3D printing can't replace the feeling of purchasing a premium item inside a store, which includes the chance to become a part of a store's concept and enjoy great workmanship. That is not to say that 3D printing should be dismissed. Rather, luxury brands should welcome 3D printing as element of a changing fashion landscape that permits them to experiment with new designs and materials, as well as develop new theories and procedures, in order to appeal to refined preferences.

Fashion companies will soon be able to move considerably faster than we can think, thanks to all of the new technologies, and the day will not be far away when we will be able to download our garments. After offering so much to the luxury fashion industry, there is no looking back for

3D printing technology. People are expecting more and the time isn't too far when most of the work will be carried using 3D printers. 3D printing is solidifying its position in the luxury market, from finished designs to behind-the-scenes operations. The technology is combined with the experimentation skills of artists to create artistic works. In particular, the innovative value of fashion as an art was created by combining the artist's creative 3D modelling technical support and the designer's imagination.

Despite the fact that Louis Vuitton's legendary label can be seen in each design capital around the world, the future study could see how fast the 3D market will expand globally. Upcoming 3D costume printing study should concentrate on the improvement of innovative filament material, the interaction among element choice and the printed garment's elasticity, and so on. The research could also examine into promotional communication techniques and how consumers can sell 3D-printed clothes. According to Perry (2018), more research on customer perceptions is needed, which might take the form of a quantitative study in order to produce general conclusion.

7. Research Contribution

The author through her study of LV's recent market strategies and updating of manufacturing process is able to offer state-of-the-art products produced in a fraction of a time. This revamping of products and catalogues caters to Gen Z clientele and aligns the brand to the speedy change that the customer groups want in a world of fast fashion and digital technology. The study will encourage educators and students to develop the skills they need to effectively apply in the classroom. Many disciplines, including biology, geography, mathematics, and more, can benefit from the use of 3D printing, and not just those in the engineering and design fields. Moreover, the research has the potential to make an abstract concept or set of words into something that can be held in one's hand and explored in one's own way. Students, when given the freedom to use 3D printing, will amaze you with the incredible things they design and build. The research may also pave the way for novel scholastic endeavours, cross-disciplinary partnerships, and cutting-edge scientific investigations.

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