



GENERATIVE AI AND JEWELRY MANUFACTURING

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INTRODUCTION

Imagine you are living at the time when humans were learning to harness fire. Before the mastery of fire, life was pretty basic: raw food and dark caves. But learning to control fire changed everything. Or consider the invention of the wheel and how that revolutionized transportation, agriculture and trade. Other breakthroughs such as the domestication of plants and animals, the use of metallurgy, writing systems, electricity, building the internet - all introduced profound change to the human experience.

We stand at the threshold of equally transformative innovations. The rise of Generative AI (Gen AI) and other breakthroughs with Artificial Intelligence (AI) begin a new chapter in our history. The explosion of AI, and Gen AI in particular, ushers in change as radical as taming fire.

This paper explores Generative AI and its early adoption in jewelry manufacturing. It is organized by:

1. Executive Summary
2. An overview of Generative AI
3. Gen AI and Jewelry Manufacturing
4. Generative AI Market Overview
5. Next Steps
6. Conclusion

1. EXECUTIVE SUMMARY

Generative AI (Gen AI) is poised to radically transform the jewelry industry. The unique capability of Gen AI to create new content – at remarkable speed – distinguishes this new technology from traditional or analytical AI. Across the value chain early adopters are beginning to integrate Gen AI into their processes.

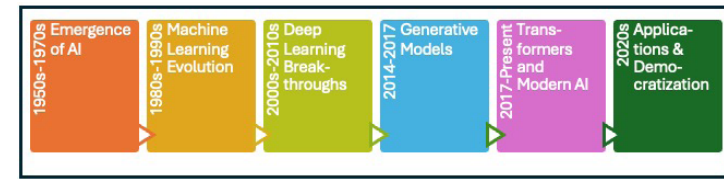
Marketing professionals, for example, are learning to use Gen AI for research, planning and content creation. Designers find inspiration from Gen AI new design ideas. In production, Gen AI, combined with traditional AI, provides the opportunity to improve inventory management, supply chain optimization, quality control, machine maintenance. Customer service leverages Gen AI chatbots to enhance online customer service interactions.

While Generative AI offers immense potential, it comes with challenges. Key issues center around Gen AI performance: it makes mistakes while sounding very sure the information is right; this is called hallucinating. Sometimes it is difficult to understand Gen AI decisions, also known as “explainability”. There is often bias in the data, skewing results. Intellectual property issues, applying copyright licensing all become more complex. And then there is the fact of malicious actors using Gen AI for bad purposes, such as deep fakes.

In spite of these risks, Gen AI applications have been adopted faster than any consumer application in history. It is here to stay. Business leaders must decide “how” not “if” to integrate these powerful capabilities into their business processes. They must find ways to balance the risks with the benefits. This may be done in part by establishing a clear vision for adoption that aligns with strategic business goals, introducing new guardrails and governance frameworks, establishing internal education and disciplined change management practices and building new networks and resources in the new world such as collaborating with regulatory bodies and using Creative Commons licenses.

Business leaders that begin now to experiment with Generative AI will have a competitive advantage over those who do not. Early adopters have primarily embraced Gen AI for marketing, jewelry design and customer service functions. They are seeing the benefits of reduced processing time, and operational efficiency, deeper customer engagement and revenue growth.

2. OVERVIEW OF GENERATIVE AI



Source: Summarized and generated using ChatGPT (OpenAI)

Figure 1: Generative AI and development timeline

Generative AI is a subfield of Artificial Intelligence. A simple definition for Gen AI is a “type of artificial intelligence that creates new content, such as text, images, music or designs, based on patterns and examples it has learned from existing data”¹

To more fully understand Generative AI, it is helpful to begin with an understanding of the basic building blocks.

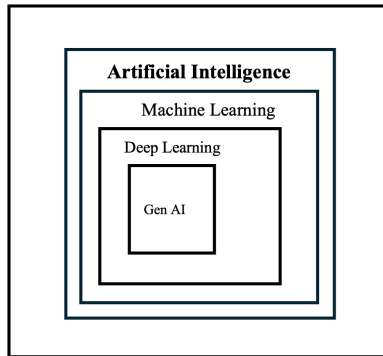
At the broadest construct is Artificial Intelligence. This the “capability of a machine to imitate intelligent human behavior”² AI involves creating machines that can perform tasks that typically require human intelligence. It spans a wide range of techniques, including machine learning, natural language processing, computer vision and robotics. What’s fundamentally different about AI is the ability for computers to learn. Systems are not programmed. They learn from data. These techniques enable computers to understand language, reason, recognize speech, make decisions, navigate the visual world, learn and manipulate physical objects.²

AI uses sophisticated algorithms and models that allow:

- computers to process and analyze vast amounts of data
- learn from the data
- use that learning to perform various tasks²

AI is defined as a general purpose, foundational technology. It is a base layer. Developers will build tools and applications using general AI capabilities. Huge data sets will provide foundational models – that will be used in a variety of applications. Innovators will build broad based commercial tools, and these will become specialized to create unique products and services. ChatGPT for example, becomes the framework for enhanced customer service bots. AI will be transformative across industries. This is already evident by the adoption of AI in healthcare, finance, retail, manufacturing, and agriculture.²

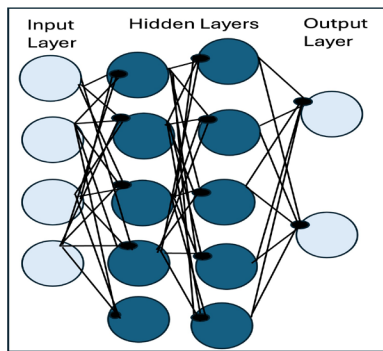
2.1 Subfields of AI



Source: "AI Fundamental for Business Leader",
I. Almeida, 2024

Figure 2: Layers of AI

Artificial Intelligence processes and analyzes data on a scale and at speeds unparalleled in history. At the heart of this is the subfield of machine learning. Machine Learning (ML) focuses on creating algorithms and models that allow machines to learn without being programmed. The systems are trained to recognize patterns and make predictions or decisions based on that data. They improve over time. An example of machine learning is when a streaming service, like Netflix, learns from past viewing behaviors and recommends a movie based on previously selected titles. ML is increasingly used in e-commerce, cybersecurity and finance. Examples include product recommendations, spam filters and credit card fraud.²



Source: reproduced from <https://medium.com/@aunisa.amin/understanding-the-foundations-of-artificial-neural-networks-anns-3d193a5110d9>

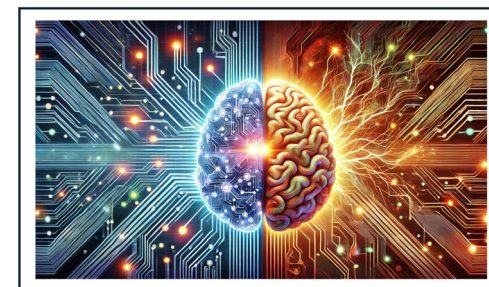
Figure 3: Artificial Neural Network Architecture

Deep Learning (DL) is a subfield of Machine Learning. Deep learning uses artificial neural networks (ANNs), which are modeled after the structure of the human brain. A neural network is composed of layers of neurons that process input data, learn from it and communicate with each other to produce an output. Deep learning is often used for image and speech recognition, natural language processing and other tasks that require a deep understanding of complex data. Natural Language Processing (NLP), for example, enables AI systems to 'read' and understand human language, turning text and speech into a form that machines can process and respond to.²

Neural networks are sometimes called artificial neural networks (ANNs) or simulated neural networks (SNNs). They are a subset of machine learning, and at the heart of deep learning models.²

Which leads to Generative AI (Gen AI). Gen AI is a subset of deep learning. It uses ANNs to learn patterns in context and generate new content based on those patterns. From existing data and based on its training, Gen AI can create new text, images, music or other types of content.²

In all these instances, data is critical. The more data machine learning has access to, the better it can learn and make accurate predictions. This is especially true with Deep Learning as it can learn and identify complex patterns in data.²



Source: generated by ChatGPT (Open AI)

Figure 4: AI and Human Brain Differences

2.2 Differences between Gen AI and Our Brain

While extremely sophisticated and modeled after the human brain, these systems are different from human-level intelligence. These differences may be summarized as:

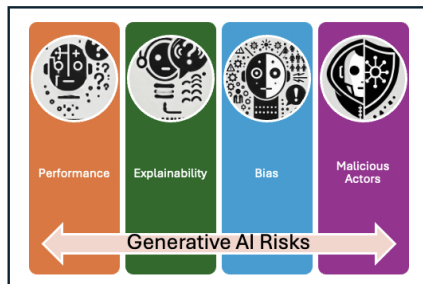
- *context understanding*: AI systems rarely grasp the nuances of

language, intent or unspoken elements of communication that humans naturally decipher.

- *common-sense reasoning*: AI can only infer what it has been specifically programmed to understand or what it can learn from extensive data.
- *learning efficiency*: Machine learning is a different process from human learning in that humans can generalize from a few examples or experiences, but machine intelligence requires thousands and millions of examples to learn effectively.
- *emotional intelligence*: Machines can at best simulate emotional intelligence based on programmed responses or learned behaviors, but they don't experience emotions.
- *creativity and innovation*: Machine intelligence, while able to generate novel combinations of known elements, doesn't truly innovate or create in the same way because it lacks the capacity to think beyond its programming or learned data.²

AI advancements continue to blur the lines between human and machine learning. Yet, while generating impressive outputs, these systems lack the ability to question, reflect or reason like human intelligence. They ingest vast amounts of structured and unstructured data, learn patterns and relationships and make predictions or decisions. All at incredible speed.²

One way to approach AI is to consider these tools as systems that supplement and enhance human abilities. Instead of replacing humans, organizations focus on ways in which Gen AI improves work and reshapes how work gets done. They become “co-creators” or an assistant. These tools work in concert with human input and oversight to drive innovation, improve processes and use data-driven business insights to make better decisions.²



Source: icons generated by DALL-E via ChatGPT (Open AI)

Figure 5: Potential risks associated with AI

2.3 Potential Risks of Generative AI

However, it is important to recognize the risks as well as the rewards of this powerful technology. While AI performs tasks beyond human capabilities, it is still evolving and comes with limitations, for example:

- *performance*: AI can make mistakes. It is only as good as the data used in its training. If the data is flawed and biased, the AI system will be flawed and biased. In generating new content, it can also make up answers, references or details that aren't true. The AI system guesses what seems right based on its training but doesn't actually check to make sure it is right. This is called “hallucinating” and is one of the most commonly sighted issues to address.
- *explainability*: AI is often a black box. It is difficult to understand why an AI system made a certain decision or took a specific action.
- *bias*: This is an important consideration when building AI systems. Biased data can perpetuate and amplify existing biases in society. It's important to use diverse and representative data when training AI systems.
- *intellectual property*: By potentially creating outputs that infringe on copyrighted materials or fail to properly attribute original creators, AI introduces complex intellectual property issues
- *malicious actors*: AI can be misused to create fake videos, manipulate data and create new adversarial attacks and threats that are difficult to detect.²

When working with AI, leaders need to balance and develop guardrails and governance frameworks to manage the new opportunities, and the risks associated with this transformative technology.

2.4 Traditional AI and Generative AI

In addition to understanding AI basics, it is important to recognize the differences between Traditional or Analytical AI and Generative AI. Traditional AI focuses on analyzing existing data to recognize patterns, make predictions, and automate specific tasks based on predefined rules. It excels in tasks like inventory management, sales forecasting, and customer segmentation. However, it operates within the confines of its programming and cannot generate new text, designs or concepts beyond its training data.³

- An example of a Traditional AI application is IBM Watson and a healthcare solution, which leverages natural language

processing and pattern recognition to sift through vast amounts of medical data, aiding in diagnosing diseases and suggesting treatments.

Generative AI, on the other hand, does generate new content. This ability to create new distinguishes Gen AI from traditional or analytical AI. It leverages machine learning techniques to learn from vast amounts of data and generate new content autonomously.⁵

- An example of a Generative AI application is DeepArt, which uses neural style transfer to transform user-uploaded photographs into works of art in the styles of various famous painters.⁶

3. GENERATIVE AI AND THE JEWELRY INDUSTRY



Source: generated by ChatGPT (OpenAI)

Figure 6: Gen AI and jewelry industry transformation

Generative AI is transforming jewelry manufacturing across the value chain – from sales and marketing, customer engagement, design, purchasing, production and customer support functions. These are still early days, but Gen AI is expanding at remarkable speed. It is estimated, for example, that ChatGPT reached 100 million active users just two months after launch, making it the fastest growing consumer application in history.⁷

To provide an overview of how Generative AI applies to jewelry manufacturing, the following sections introduce Gen AI capabilities across the major process areas of marketing, design, production and customer service.

3.1 Marketing

Gen AI capabilities to ingest and summarize vast amounts of

data and generate new content makes it a compelling marketing assistant. The analytic capabilities of Traditional AI provide insights to optimize marketing strategies including, for example: trend analysis, lead generation and targeting, improved marketing content, Search Engine Optimization (SEO), and other data-driven marketing functions. Combined with Gen AI, these technologies are poised to deliver precise, personalized customer experiences, while radically streamlining marketing processes.



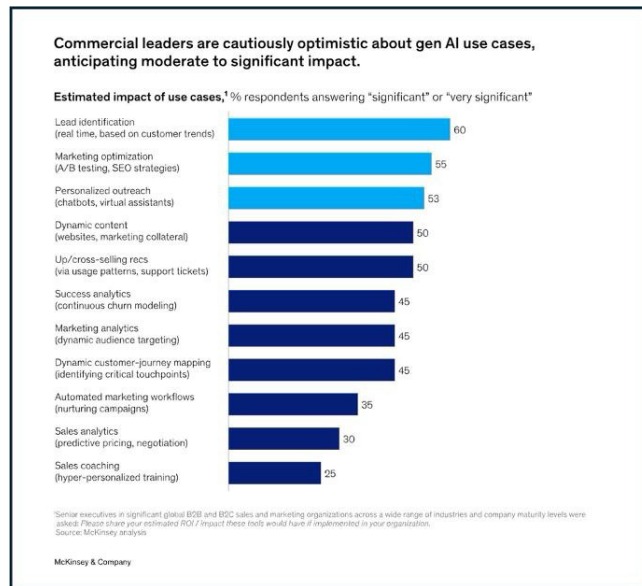
Source: generated by ChatGPT (Open AI)

Figure 7: Generative AI and capabilities and marketing

A business study by McKinsey & Company, an American multinational strategy and management consulting firm, found over 50% of respondents thought Gen AI would have “significant” or “very significant” impact on the top five marketing use cases of their survey.⁸

The ability to generate new content from existing copy, images and other data means a marketing professional can partner with Gen AI for writing assignments. It automates content generation and increases the speed to create marketing materials. This could include for example, tailored emails, social media or blog posts, story outlines and video scripts, product descriptions with highly specialized images, demos and engaging advertising.

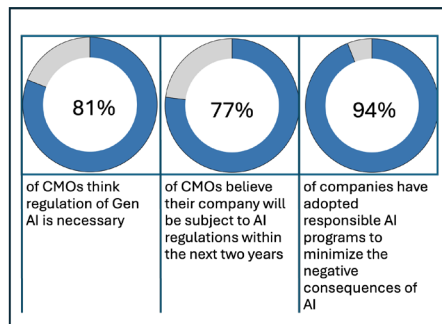
Customer expectations continue to rise around personalization, with customers seeking individualized experiences and products. Unlike analytical tools, Gen AI models, coupled with company-specific data and context, can generate “hyper-personalized” content and offerings based on individual customer behavior, persona and purchasing history.⁹



Source: <https://www.mckinsey.com/capabilities/growth-marketing-and-sales/our-insights/ai-powered-marketing-and-sales-reach-new-heights-with-generative-ai>

Figure 8: McKinsey report: AI powered marketing and sales reach new heights with Generative AI

Marketing professionals also use Gen AI as a research assistant or planning assistant. If, for example, the marketing plan includes regular blog postings and other social media content, Gen AI can generate content ideas and then research those ideas. The marketer should still validate the research and create the final copy, but Gen AI tools generate new ideas and then research those ideas at incredible speed.



Source: reproduced from <https://www.bcg.com/publications/2023/generative-ai-in-marketing>

Figure 9: Managing Gen AI risks in marketing

3.1.1 Generative AI and Marketing Risks

These automated benefits come with risks. Gen AI should be used in conjunction with, not instead of, skilled professionals. Some of the top challenges for marketing Gen AI opportunities are:

- **intellectual property rights:** Foundational models may not discriminate between licensed and copyright content and publicly available content, leading to messy copyright infringement and plagiarism.
- **brand integrity:** Brands have a distinct voice. At this point, Gen AI lacks the emotional intelligence of human creativity. Using just AI generated content can mute the personality of the brand – with unintended and negative consequences.
- **accuracy:** Sometimes AI algorithms get it wrong, making decisions on incomplete or inaccurate information, or even generating offensive content.⁹

In proceeding with Gen AI, marketers should:

- **build guardrails:** Understand which specific aspects of their campaigns lend themselves best to AI and build guidelines around the use of Gen AI for those specific instances.
- **become knowledgeable:** Familiarize themselves with the background of any foundation models used and rigorously and frequently test AI models executed in the processes.
- **monitor and manage:** Apply common sense and oversight to the automation of new content creation.
- **engage experts:** Collaborate with legal experts, intellectual property specialists, and AI ethics consultants to ensure compliance with copyright laws and mitigate risks such as brand integrity and data bias.
- **leverage available resources:** Such as Creative Commons licenses.¹⁰

Andrea Hill, owner of Hill Management Group and the Werx brand, for example, advises companies to establish clear guidelines for using Generative AI; to be very thoughtful and not use AI output as final output; and when using Gen AI to enhance personalization and operational efficiency, do so with a clear strategy that aligns with the company brand values and customer expectations.¹¹

3.1.2 Marketing Use Cases: Jewelry Examples



Source: generated by ChatGPT (OpenAI)

Figure 10: Gen AI and early adopters in the jewelry industry

Early adopters of Generative AI in jewelry manufacturing marketing are generally focusing on online content creation. They leverage models like DALL-E or Stable Diffusion to generate detailed images from text descriptions, CLIP.ai to match images with descriptive text or to create relevant content from images, and Text-to-Video platforms like Synthesia to rapidly create video content. These tools enhance customer engagement while significantly reducing the time required to create images, videos, and text.¹²

For example, FancyTech, a developer of augmented reality technologies and applications, developed a platform that uses AI-generated video scripts to control video movements and lighting effects in video production software.

- Combined with 3D models, the videos are generated rapidly in high quality. They are said to feature movements impossible to achieve manually.¹³ Fancy Tech was awarded the LVMH 2024 Innovation Award at the VivaTech (Viva Technology) conference in Paris. This award is an annual recognition presented by the luxury conglomerate LVMH to celebrate innovative startups and reaffirm the importance of initiative.¹⁴

Hublot, a Swiss luxury watchmaker, worked with FancyTech when launching an e-commerce platform Tmall in China.

- The challenge was to produce 80 videos for 80 Stock Keeping Units (SKUs) in a very short period, which would “be almost impossible using the traditional way for production” according

to FancyTech co-founder Morgan Mao. Hublot provided FancyTech with a script to describe the kind of videos they wanted to achieve. FancyTech’s model could replicate the script into different SKUs to make the videos. The process took two weeks, and Hublot’s Tmall flagship store now includes multiple videos.¹⁵

Blng, a Creative Suite designed for the jewelry industry, provides another example of Gen AI for content creation.

- Their platform “allows designers to quickly turn inspirations into precise, tangible products.”¹⁵ A key deliverable in their suite of offerings is photorealistic 3D renders of jewelry designs for marketing materials. In 2024, they were also presented with an LVMH Innovation Award at Viva Tech.¹⁶

It is not just startups that are tapping the unique capabilities of Gen AI for marketing. Tiffany, an American luxury jewelry and specialty design house, for example, have partnered with Synthesia, a Gen AI platform, “to provide video content without traditional cameras, microphones or studios.”¹⁷



Source: generated by ChatGPT (Open AI) based on input from the Cartier use case

Figure 11: Generative AI and artificial reality experiences

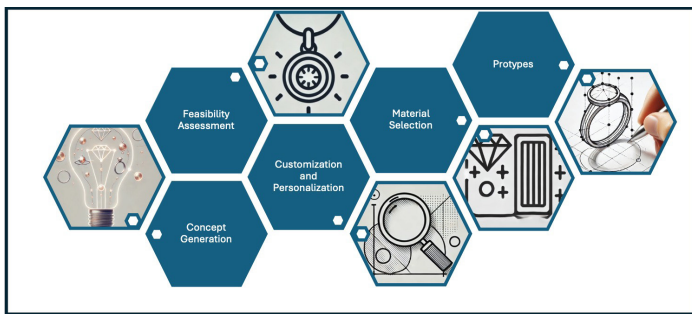
Cartier, a French luxury goods company, and Tiffany have both partnered with Snap Inc., a technology company, to “make the world a bit more interactive and a bit more fun” according to Geoffrey Perez, head of luxury at Snap.¹⁸

- The Cartier watch experience uses an augmented reality filter to transport the user to the Pont Alexandre III bridge in Paris. The virtual experience lets you see iterations of the watch from different periods over the past 106 years and then look around the bridge and follow pedestrians to get a sense of that era.¹⁹

- Tiffany uses ray tracing technology, a technology from video games, which captures the movement of light on Augment Reality (AR) objects more realistically. This means that the unique sparkle of metal and diamonds can be translated into AR.¹⁹
- Both Cartier and Tiffany integrate AR technology to create a virtual try on experience. In celebration of the 100th anniversary of its Trinity collection, Cartier online visitors can virtually try on the classic ring via Snapchat, providing a realistic and interactive experience that mirrors in-store try-ons.¹⁹
- Tiffany has integrated AR technology into its mobile application, allowing customers to virtually try on engagement rings, facilitating informed purchasing decisions without visiting a physical store.²⁰

Generative AI is impacting jewelry marketing by streamlining content creation, from personalized texts to high-quality visuals and AR experiences. It enables faster production of marketing materials and enhances customer engagement through hyper-personalized interactions. These capabilities do not replace the skilled marketer. Human oversight preserves brand authenticity and avoids risks like copyright issues or Gen AI model inaccuracies. With a well-defined strategy, clear guidelines and governance, this technology is poised to radically transform marketing processes.

3.2 Co-Creation and Design



Source: Icons generated by ChatGPT (Open AI)

Figure 12: Co-Creation and jewelry design

Using Gen AI for co-creation and streamlining the design and customization processes are some of the fastest growing areas of adoption in the jewelry industry. Part of the motivation behind this adoption are Gen AI's innovation and speed. While not exclusive to jewelry, Generative AI "has been shown to substantially decrease design time across various industries. Specifically, in manufacturing, such software can cut design time by 50%".²¹

The capabilities of Gen AI to consume vast amounts of data, recognize patterns, respond to input and create new content means AI algorithms can generate unique jewelry designs based on style preference, historical data, market trends or customer data.²²

Gen AI as a design assistant provides an excellent use case for exploring this technology. Michael D. Magee, Manager of Jewelry Manufacturing Arts, Gemological Institute of America, states: "Sometimes referred to by a play on words 'AIdeation' quickly creating ideas as a starting point, is becoming the most common use case for AI in design. With an input consisting of only a few words, AI can generate many iterations from a single concept or idea". This helps designers focus on refining ideas instead of starting from scratch. For retail shops, it means a jeweler can work directly with their customer to tailor a design based on their input around gemstone, shape, size or material.²³

Steven Grotell, Design Director, Delmar Jewelers, a manufacturer in Montreal, Canada said: "I used to get inspired by random images in movies, catalogs and books; now I can use AI".²⁴

Table 1 shows a ChatGPT (Open AI) prompt, summarizing information from publicly available sources, provided the following jewelry design steps where Gen AI could play a role.

Table 1: Potential role of Generative AI in jewelry design

Aspect	Role of Generative AI	Benefit	Source
Concept Generation	Analyzes trends and customer preferences to generate innovative design concepts.	Accelerates the ideation phase, providing designers with a diverse array of starting points.	Forbes - AI's Role in Jewelry Design
Customization and Personalization	Allows for real-time customization of designs based on individual customer inputs.	Enhances customer engagement and satisfaction through personalized jewelry pieces.	Digital Defynd - AI in Jewelry Business
Feasibility Analysis	Evaluates design feasibility by analyzing material properties and manufacturing constraints.	Identifies potential issues early, reducing the risk of production challenges.	GIA - Generative AI in Jewelry Design
Material Selection	Suggests optimal materials based on design requirements and availability.	Ensures designs are practical and cost-effective, optimizing material usage.	LeewayHertz - Generative AI for Manufacturing
Prototyping	Generates detailed CAD models or 3D-print-ready files for prototyping.	Facilitates rapid prototyping, allowing for quick iterations and design validation.	Dalle5 - Jewelry Design with Generative AI

3.2.1 Generative AI and Design Considerations

These are still early days for Generative AI in the jewelry industry, but the technology and its applications are advancing rapidly. In addition to generating visual references for novel designs, Gen AI tools can streamline the manual and time-consuming process of preparing 3D models, such as removing tracing steps and vectorizing images. “The technology to create 3D models is here today, but it will need some refinement before it becomes part of our daily workflow,” said Michael Tracy, Art Supervisor at Herff Jones, a provider of scholastic, collegiate, and championship rings. For example, he cautions the design, while beautiful, may not be manufacturable. For instance, it may lack structural integrity, have material constraints or be impractical for everyday wear. It may also include elements that just don’t make sense – like three arms or six fingers on an image. “But”, he says, “it won’t take long for the technology to get here.”²⁵

The trick is to combine the creativity and speed of AI with the skills and knowledge of a designer. “Going forward, the two greatest assets for a designer using these tools will be the ability to translate images into actual models ... and the ability to personalize or customize, pushing designs further toward a specific direction or purpose.”²⁶

3.2.2 Generative AI and Design Risks

The advancing technology also introduces ethical, legal and regulatory challenges to consider, similar to the marketing challenges. Sophisticated AI-generated designs, for example, could make it easier for bad actors to replicate unique jewelry designs. AI tools can be used to mimic an original design, or in the style of a particular artist, without proper acknowledgement or compensation. Questions around copyright and intellectual property are complex and evolving.



Source: Summarized by ChatGPT (OpenAI), <https://www.mckinsey.com/capabilities/strategy-and-corporate-finance/our-insights/managing-the-risks-around-generative-ai>

Figure 13: Overcoming Gen AI challenges for jewelry design

In this volatile environment, companies are developing strategies to address the challenges brought on from Generative AI. These include, for example:

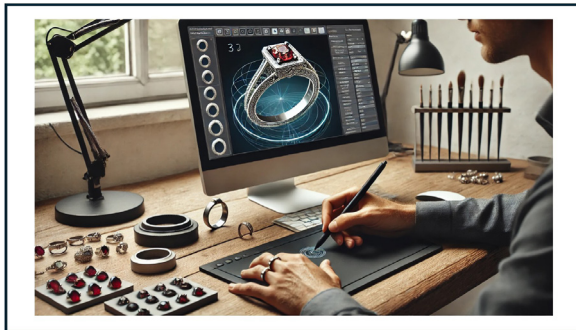
- Set clear rules and oversight:
 - ◊ Decide how and where to use AI responsibly, with clear guidelines.
 - ◊ Always keep humans involved in decisions based on AI outputs.
- Build strong risk management systems:
 - ◊ Identify and monitor risks like bias, privacy issues, and security threats.
 - ◊ Regularly check how AI performs, and update safeguards as needed.
- Follow regulations and build trust:
 - ◊ Stay updated on laws and rules for AI in different countries.
 - ◊ Ensure transparency and about the use of Generative AI.
- Train employees and build a risk-aware culture:
 - ◊ Teach employees how to use AI safely and spot risks.

- ◇ Make risk management part of everyday work and involve teams across the company.
- Use AI to manage risks and grow with intelligence:
 - ◇ Use AI tools to improve security, like detecting deepfakes or scams.
 - ◇ Grow your AI use carefully by building in-house skills and balancing technology with human oversight.²⁷

As laws and compliance regulations change, it is important for jewelry designers to stay informed and educated. This is not an easy task, and the information changes frequently. ChatGPT (Open AI) pulled this helpful list of resources together:

- World Intellectual Property Organization (WIPO): <https://www.wipo.int/>
- United States Copyright Office: <https://www.copyright.gov/>
- American Bar Association – Intellectual Property Section: https://www.americanbar.org/groups/intellectual_property_law/
- Creative Commons: <https://creativecommons.org>.
- National Association of Jewelers: <https://www.naj.co.uk/>
- Jewelers of America: <https://www.jewelers.org/>
- Law Journals and blogs, jewelry industry associations, academic institutions and research papers, technology and legal conferences, online learning platforms.

3.2.3 Co-Creation and Design Use Cases: Jewelry Examples



Source: generated by ChatGPT (Open Source)

Figure 14: Co-creation and jewelry design examples

At the 2024 MJSA Expo AI Zone presentations, Mr. Greg Stopka, owner of JewelSmiths, a design company in Northern California, shared the success he has experienced using Gen AI techniques:

- “Within the last two months”, he said, “I sold 18 designs, averaging \$5,500. Some were \$8k, others \$3K, but the average was \$5,500”.
- “It is a stunning way to be able to convey gorgeous pictures from images. It puts you on a different level to be able to showcase images that are very colorful and emotional, we use them to be able to convey top level design work”.
- “It has transformed my business in a short amount of time because when I do put these up [the AI generated designs on the company website] I notice that ... we’re getting a lot more views and a lot more sharing of the posts”.
- Mr. Stopka also explains how he uses the two types of Gen AI prompts: either the prompt for an image, or the image-to-image prompt. He prefers the second prompt as it allows him to bring in his own design, and then use the prompt to describe the background, the colors in the gemstone, and the color of the metal to create vibrancy and excitement. By starting with his own design, it reduces the risks around intellectual property. He commented: “this is actually game changing if you know how to use it. Not only does it put a small designer on equal footing with those having larger budgets ... to showcase their gorgeous designs, but it only takes minutes to create. You can put together 50 designs within an hour’s time.”²⁸

Integrating Gen AI with consumer data led the design team at Delmar Jewelers to create a new design for a Mother’s Day collection.

- To get started, they drew insights from sales data to craft multiple core personas. By then understanding the ring styles purchased for Mother’s Day in the targeted demographic, they created a prompt for the Gen AI tool. While the output had limitations, Steve Grotell, Director of Design, was inspired by a detail: “I was captivated by a particular image ... an innovation hovering between bezel and prong settings, a concept I would have never conceived. While its realization may pose challenges, its inspiration was undeniable. I would not have come up with this on my own, had I not seen this first.”²⁹

Generative AI stands to transform jewelry design by accelerating customization and ideation. Its ability to generate unique designs

and streamline workflows helps jewelers focus on refining ideas rather than starting from scratch. However, these creative and operational advantages require human oversight to ensure the designs make sense, are manufacturable and do not violate intellectual property or licensing concerns. Going forward AI's speed, creativity and photo realistic outputs, combined with designer expertise makes this an intriguing tool for the industry.

3.3 Production



Source: generated by ChatGPT (Open AI)

Figure 15: Generative AI and jewelry production

While there is early adoption and experimentation of Gen AI in areas such as marketing, design and prototypes, the unique capabilities of Gen AI to create, adapt and iterate also offer compelling transformation opportunities across production domains. Many of the use cases of AI in manufacturing however are based on Traditional AI. This includes, for example, the use of predictive analytics to manage stock levels and improve inventory management or analyzing supplier performance and delivery schedules to optimize the supply chain.

But Generative AI goes beyond analyzing and optimizing what is. Gen AI can create new possibilities. By learning patterns and generating new content, it is more flexible and adaptive than Traditional AI. Traditional AI excels in structured environments, Gen AI excels in complex, dynamic environments.³⁰

With Gen AI, for example, the inventory management solution could “continuously generate optimized replenishment plans based on real-time demand signals, supplier lead times and inventory levels”.³¹

Gen AI's unique capabilities can optimize demand forecasting, inventory, supply chains, manufacturing, material use, quality control, and maintenance to boost efficiency, reduce costs, and enhance product quality.³² A brief comparison of six use cases from a ChatGPT (Open AI) prompt, summarizing information from publicly available sources, highlights the differences between Traditional or Analytical AI and Gen AI, and conceptualizes how Gen AI could be applied to enhance the solution for jewelry production (Table 2).

Table 2: Comparison of Traditional or Analytical AI and Generative AI

Use Case	Traditional AI	Gen AI Enhancement	Example	Source
Demand Forecasting	Relies on historical data to predict demand patterns	Simulates scenarios with market trends and unpredictable factors to propose adjustments	Proposing a sustainable jewelry line for a holiday season	Forbes - "AI in Retail Analytics"
Inventory Management	Tracks stock levels and predicts restocking needs	Adapts inventory dynamically based on external factors	Recommending recycled gold as a substitute during a shortage	McKinsey & Company - "Industrial IoT generates real value—if businesses overcome six myths"
Quality Assurance	Detects flaws in products using image or pattern recognition	Predicts defects by analyzing production factors and identifies critical areas	Monitoring mold temperature to avoid casting defects	IEEE Xplore - "Artificial Intelligence for Product Quality Inspection toward Smart Industries"
Predictive Maintenance	Monitors equipment health to predict and prevent breakdowns	Anticipates maintenance schedules using AI-driven insights	Scheduling production downtime before critical machine servicing	McKinsey & Company - "A manufacturer's guide to scaling Industrial IoT"
Supply Chain Optimization	Analyzes logistics and supplier performance to improve efficiency	Simulates entire supply chain, detecting bottlenecks and inefficiencies	Switching to 3D-printed components to reduce lead times	McKinsey & Company - "Where and how to capture accelerating IoT value"
Process Efficiency and Waste Reduction	Tracks energy usage and optimizes methods or workflows to maximize material reduction	Recommends new cutting patterns, reduces waste by 20%	Optimizing gemstone-cutting techniques to reduce waste by 20%	IEEE Xplore - "Leveraging AIoT for Advanced Quality Control in Production Lines"

3.3.1 Production Use Cases: Jewelry Examples



Source: Summarized and generated by ChatGPT (Open AI) and based on this image:
<https://shop.mirakin.com/blogs/news/the-dazzling-future-3d-printing-in-the-jewellery-industry-with-a-glimpse-of-japans-role>

Figure 16: Generative AI and jewelry production use cases

Companies have begun integrating traditional analytical AI in jewelry manufacturing processes. But while there are studies that highlight the potential of Generative AI, and examples from other industries, references to published case studies were hard to find. The following table built by ChatGPT (Open AI) using publicly available sources, summarizes the potential use cases for Gen AI in jewelry production processes.

Table 3: Potential use cases for Generative AI in jewelry production

Category	Description	Source
Toolpath Optimization	Generative AI can optimize toolpaths in CNC machining and 3D printing, improving precision and reducing material waste. A study explores how Gen AI models can generate efficient manufacturing strategies.	<i>Journal of Advanced Manufacturing Processes</i> : "Generative AI for Toolpath Optimization: Enhancing Precision and Reducing Material Waste" (2023).
Materials Optimization	Gen AI assists in creating designs that consider material properties and manufacturing constraints. The research discusses frameworks generating manufacturable designs.	<i>Journal of Additive Manufacturing</i> : "Optimization with Artificial Intelligence in Additive Manufacturing: A Systematic Review" (2023).
Rapid Prototyping	Generative AI accelerates the prototyping phase by swiftly generating design variations. AI-driven parametric tools enable designers to create stunning and unique pieces rapidly, facilitating faster iteration and reduced time-to-market.	<i>Design Engineering Applications Journal</i> : "Sketch2Prototype: Rapid Conceptual Design Exploration and Prototyping with Generative AI" (2023).
Custom Tool Creation	Generative AI facilitates the design of custom tools tailored for specific manufacturing processes. The study examines AI-driven generative design creating optimized tools and components.	<i>International Journal of Tool Design and Applications</i> : "Generative Design and Topology Optimization of Analysis and Repair Work of Industrial Robot Arm Manufactured Using Additive Manufacturing Technology" (2021).
Eco-Friendly Alternatives	Generative AI contributes to sustainable manufacturing by designing products that minimize material usage and energy consumption. The research discusses applying Gen AI to develop eco-friendly processes.	<i>Journal of Sustainable Manufacturing and Innovations</i> : "Nature's Lessons, AI's Power: Sustainable Process Design with Generative AI" (2023).

However, as illustrated in Table 2, Comparison of Traditional AI or Analytical AI and Generative AI, Traditional AI solutions provide a foundation for Gen AI enhancements. Jewelry manufacturers have begun adopting AI solutions, and in this way, they are paving the way for production Gen AI solutions.

Signet Jewelers, for example, initiated a project to improve inventory management and reduce lost sales due to out-of-stock merchandise.

- They implemented a forecasting and replenishment project utilizing AI and machine learning algorithms. These technologies analyzed sales data, customer preferences and inventory levels to predict demand and optimize stock replenishment. The system has enabled Signet to recapture sales that might have been lost due to stockout. By stocking

popular items, the company has improved customer satisfaction and increased sales.³³

DeBeers, a leading diamond company, utilizes AI-driven laser cutters for diamond cutting.

- Advanced algorithms optimize each cut to maximize the diamond's brilliance and minimize waste, enhancing both the aesthetic quality of the jewelry and manufacturing efficiency.³⁴



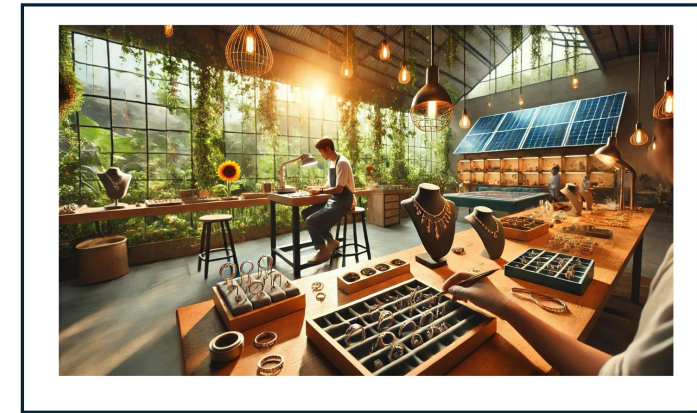
Source: <https://www.gcalusa.com/blog/gcal-8x-video/>

Figure 17: GCAL use case

GCAL by Sarine is another example of Traditional AI integrated with diamond grading processes, enhancing precision and consistency. Tim Clark, Vice President, Head of Brand Journalism at SAP, describes the solution as:

- “AI powered machines analyze each diamond’s color and fluorescence, clarity and polish, symmetry, proportions and light performance, providing objective, data-driven insights, while GCAL gemologists validate and interprets these results to ensure the highest standards”.³⁵
- This combination of systems and skilled employees ensure the highest standards. Angelo Palamieri, CEO of GCAL states: “By continually refining AI capabilities, we can increase grading consistency, handle larger volumes and enter new markets with confidence that our standards remain intact. Additionally, AI will support innovative services, such as enhanced digital reports and interactive consumer education tools, helping customers better understand and trust the quality of their diamonds”.³⁶

3.3.2 Sustainability



Source: Summarized and generated using ChatGPT (OpenAI)

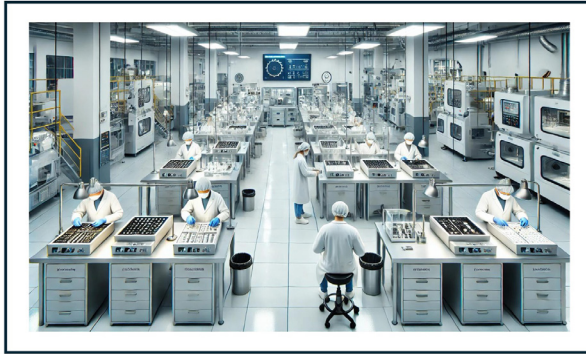
Figure 18: Using Gen AI to support sustainability goals

Creating the design is one application of Gen AI, but these models can also be trained to support sustainability goals as illustrated by Amish Shah, founder of J’evvar, a fine jewelry brand.³⁷

J’evvar uses Generative AI to determine exact material amounts before creating an item, helping with sustainability by limiting waste. Mr. Shah states:

- “If we are able to predict the exact amount of gold we’re going to need, what the design is going to be, how much cubic millimeters of gold, the wastage will go down dramatically because you know exactly what you’re looking to produce.
- More importantly, the level of precision from a point of engineering will go much higher,” he continued. “The amount of gold that is used will be very precise. How and what is printed in terms of the level of resolution will go higher, ultimately lowering the amount of wastage.”³⁷
- Gold wastage will go low, but yes, that means the speed will go up, which means the energy requirements will go down. The material wastage from wax to silicon to machine usage, everything will go down. From a sustainability perspective, AI is going to have a direct impact on sustainability or improving the reduction of wastage.”

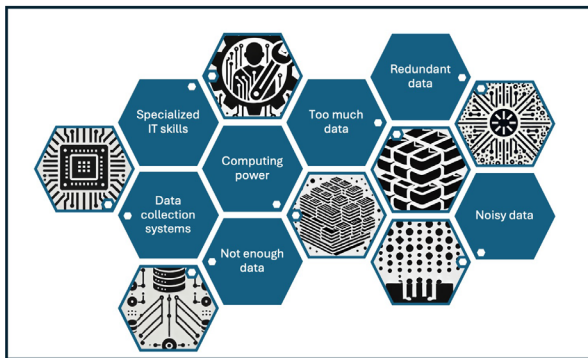
3.3.3 Production Processes and Gen AI Adoption



Source: generated by ChatGPT (OpenAI)

Figure 19: Generative AI integration with production processes

Based on current research, the adoption of Generative AI capabilities for production processes appears limited today. Tiffany, for example, has embraced advanced technologies by creating the Jewelry Design and Innovation Workshop in New York City (JDIW). The center enables Tiffany to reduce product development times and increase the number of unique expression of each design. It allows Tiffany to keep pace with emerging trends, increase speed to market and maintain its tradition of innovation. These qualities all point to Gen AI adoption, but Gen AI capabilities are not specifically called out in available source materials.³⁸



Source: icons generated by ChatGPT (Open AI)

Figure 20: Adoption challenges with Gen AI and jewelry production processes

Adoption challenges may be a reason for the slower uptake of Gen AI for production processes. Issues with data, expense, available resources and expertise as well as other challenges may make it less appealing for experimenting with this new technology in production processes. Early experiments with Gen AI tend to focus on areas where it is easier to get started, for example in marketing and design.

In manufacturing processes, building datasets for model training often requires equipping machines with sensors or other data collection systems. This can be costly and technically challenging to integrate with existing systems. Additionally, once implemented, these sensors require regular calibration and maintenance to ensure accuracy, further increasing expenses.³⁹

While there are workarounds to investing in sensor-equipped machines, such as creating virtual simulations of manufacturing processes using existing data – these solutions are not as effective as sensor equipped machines.⁴⁰

Other data challenges include too much data, redundant data, or irrelevant data (noisy data) overwhelming the Gen AI systems if not properly curated. In addition, large data sets require significant computational power for storage, processing and analysis. Managing all this data, computational power and infrastructure to process, store and integrate the data into Gen AI workflows adds complexity and expense to the projects.⁴¹

The flip side of too much data is that jewelry manufacturers may not have historical data or enough data to train the models effectively, limiting the insights generated by the Gen AI systems.

Beyond the data itself, jewelry manufacturers may lack in-house expertise in AI and data science. Hiring or training specialists is another potential barrier to experimenting with Gen AI in production processes. While companies can overcome this hurdle with external vendors – this also raises the cost and project complexity (managing a third party). In these early days, it is also challenging to find vendors skilled in jewelry manufacturing or solutions tailored to the jewelry industry. Customizing a general application brings its own set of challenges.⁴²

In addition to data and high upfront costs, the creative issues identified previously around ownership and intellectual property rights, ethical and legal concerns still apply. On the plus side, in manufacturing processes, the data is typically constrained or

proprietary, reducing these risks.

Finally, as in any change project, the biggest hurdle to adoption may be people's resistance to change. These radically different solutions require careful attention to change management disciplines.

So why bother? With the pressures of running a business in today's fast paced, complex environment – why take on the challenges of integrating Generative AI into the production processes? The answer lies in readiness. This technology is here, not coming. Getting started now, even in small ways, positions companies to learn, adapt and capitalize on the unique opportunities for improved efficiency, quality and market competitiveness enabled by Gen AI capabilities.

3.4 Customer Service



Source: stock image from Microsoft PowerPoint

Figure 21: Generative AI and customer service

The jewelry industry places high importance on building and maintaining customer relationships. Trust, transparency, reliability, consistency, personalized service, quality – all are essential elements of success. High performing customer service teams are key to providing these requirements and meeting customer demands.

Generative AI is making an impact on customer service functions. In a recent survey with service professionals:

- 68% of respondents believe it enhances customer service efficiency.
- Approximately 24% are currently using Gen AI in their work, with an additional 15% planning to adopt it in the future.⁴³

Another study highlights that 80% of respondents cite an improvement in work quality, indicating significant productivity enhancement.⁴⁴

Generative AI provides game changing capabilities for transforming the digital customer service experience. By extracting context from customer interactions and understanding intent, it enables seamless automation of tasks like note-taking and post-call processes. Additionally, by leveraging contact monitoring data and sentiment analysis, Gen AI empowers businesses to create specific, measurable, and fair quality assurance scorecard criteria.⁴⁵

The generative text capabilities, for example, enable Customer Service Representatives (CSRs) to quickly write professional replies to customer inquiries. Multimodal capabilities combine image generation with customer inquiries to provide virtual visualization of how a jewelry piece may look when worn, helping with customer decision making and reducing returns. Natural Language Understanding (NLU) enables virtual assistants to understand and respond to customer-specific inquiries.⁴⁶

Based on a ChatGPT (Open AI) prompt, summarizing information from publicly available sources, the following table highlights how Gen AI capabilities can be applied to customer service functions.

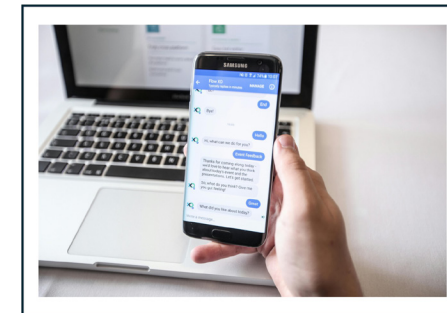
Table 4: Gen AI capabilities and potential customer service application

Gen AI Capability	Application	Source
Generative Text Capabilities	Automated Yet Personalized Responses: Generates human-like replies for customer queries about orders, warranties, or repair services.	Forrester Research, "Generative AI Transforming Customer Support"
Multimodal Capabilities	Virtual Try-On Assistance: Combines image generation with customer queries to provide virtual visualization of how a custom design or existing jewelry piece would look when worn.	MIT Sloan Management Review, "AI in Retail: Multimodal Innovations"
Natural Language Understanding (NLU)	Personalized Consultation: Enables virtual assistants to understand and respond to customer-specific inquiries regarding jewelry customization, pricing, or manufacturing processes.	Gartner Research, "AI in Customer Support: NLU Capabilities White Paper"
Real-Time Content Creation	Dynamic Product Descriptions: Creates real-time descriptions or feature lists for newly designed jewelry, especially for custom or one-off pieces.	McKinsey & Company, "AI's Role in E-Commerce Personalization"
Pattern Recognition in Language Data	Customer Sentiment Analysis: Identifies patterns in customer communications (e.g., email, chat logs) to determine satisfaction levels or emerging issues.	Harvard Business Review, "Analytics in Action: Customer Sentiment Decoded"
Context-Aware Dialogue Generation	Follow-Up Management: Retains context from past customer interactions, enabling follow-up responses tailored to the specific customer's history or inquiries.	IDC Reports, "AI-Driven CRM Solutions for Context-Aware Engagement"
Semantic Search Optimization	Efficient Knowledge Retrieval: Quickly retrieves specific details about products, services, or policies from extensive internal databases or FAQs when responding to customer queries.	TechCrunch, "AI in Knowledge Management Systems"
Continuous Learning and Adaptation	Adaptive Customer Support: Learns from ongoing interactions to refine its understanding of customer preferences, frequently asked questions, or common challenges specific to the jewelry industry.	Accenture Insights, "Continuous Learning in AI-Driven Customer Support"
Synthetic Data Generation	Training Virtual Assistants: Generates realistic, anonymized customer interaction data to train customer service models for better handling of jewelry-specific queries.	OpenAI White Paper, "Synthetic Data for AI Training Applications"
Voice Interaction Capabilities	Interactive Voice Support: Provides high-quality, real-time voice interaction for customer service (e.g., answering questions about materials, pricing, or tracking an order).	Deloitte Digital, "AI in Voice Technology for Customer Experience"

3.4.1 Generative AI and Customer Service Benefits

Integrating these Gen AI capabilities into customer service processes offers substantial benefits for jewelry manufacturers. Based on common customer service interactions and general considerations, they include:

- handling inquiries: Automating and managing routine customer questions about products, pricing and availability which reduces call times and operational costs.
- order tracking and status updates: Automating the answering of questions about real-time order status, shipping details, and expected delivery times to enhance transparency and customer satisfaction.
- after-sales support: Handling warranty inquiries, repair requests, care instructions to ensure the customer receives consistent and accurate information.
- feedback analysis: Processing and analyzing customer reviews and feedback to identify trends for improvement, enabling companies to enhance their products based on data-driven insights.
- 24/7 customer support: Automated solutions provide always-on, always-available services.
- capability of customer service operations: Gen AI solutions can handle increased customer interactions without a proportional rise in costs, supporting for example, increased volume during peak periods or special promotions.⁴⁷



Source: online pictures from Microsoft PowerPoint

Figure 22: Chatbots for customer service

3.4.2 Generative AI and Chatbots for Customer Service

Chatbots are a common entry point for companies integrating Gen AI capabilities with customer service functions. While case studies in jewelry manufacturing across customer service functions are limited, the following example illustrates how Chatbots can improve this domain.

A major manufacturing company faced significant customer service challenges due to manual processes that resulted in slow response times, inconsistent information delivery, and limited scalability. To

address these issues, they implemented a Generative AI-powered chatbot. The key features of this solution included:

- product catalog assistance: Facilitated product searches, comparisons, cross-selling, and up-selling opportunities.
- knowledge base & FAQs: Delivered instant, accurate responses from a comprehensive knowledge base built by crawling 1,900+ web pages.
- customer support: Streamlined support processes for quick resolution of customer queries.
- feedback surveys: Collected customer insights to improve services and satisfaction.
- chat analytics: Provided actionable insights to continuously enhance chatbot performance.

As a result of this implementation, the company realized the following benefits:

- customer experience: 30% increase in customer satisfaction through faster, personalized responses.
- self-service: 45% improvement in customers resolving queries independently.
- operational efficiency: 70% of interactions handled by the chatbot, reducing agent workload and costs.
- enhanced digital experience: 25% boost in positive customer feedback.
- faster resolution: Average Handling Time (AHT) reduced by 40%, allowing agents to focus on escalated cases.
- 24/7 availability: 50% improvement in service accessibility.
- revenue growth: 20% increase in retail sales from effective cross-sell and up-sell strategies.⁴⁷

3.4.3 Chatbots: Jewelry Examples



Figure 23: Chatbots: jewelry company examples

Kay Jewelers, a specialty jewelry brand in the United States, employs AI chatbots on their website to interact with customers, helping them choose the perfect engagement ring by analyzing their style preferences and budget.

- This interactive tool engages customers by simulating a personalized shopping experience, significantly enhancing customer satisfaction and engagement. Moreover, AI chatbots can manage multiple interactions simultaneously, reducing wait times and increasing efficiency. They also learn from each interaction, continuously improving their ability to resolve queries and offer relevant suggestions, thus personalizing the shopping experience.⁴⁸

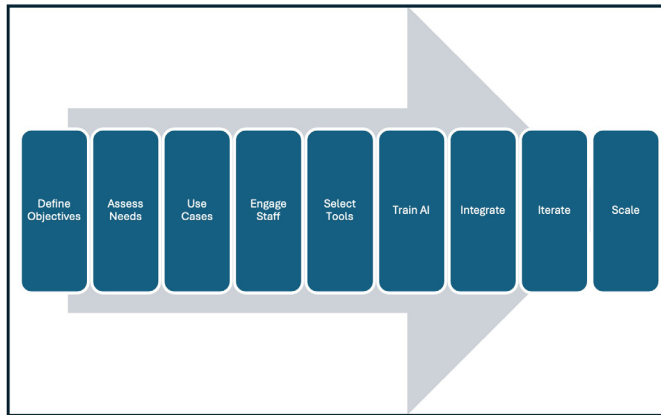
One advantage for starting a Gen AI journey with Chatbots is ease of entry. They are often relatively low-cost solutions, quick to implement and reduce repetitive workload for the Customer Service Representatives. Many customer service platforms or Customer Relationship Management (CRM) systems provide chatbots as part of their offerings. These tools generally come with prebuilt templates that can be customized in days without deep technical knowledge.

For example, a jewelry manufacturing company sought to introduce a chatbot for their customer service inquiries using their existing Customer Relationship Management (CRM) chatbot capabilities. However, most of the knowledge required to build a chatbot was locked in the heads of their CSRs.

- The first step in their goal to automate inquiries was to document “Frequently Asked Questions (FAQs)” and their correct responses. To do so, the company created a community of customer service supervisors and leads, trainers and top performing CSRs to be “subject matter experts”, or SMEs.
- This team agreed to a few simple changes to the template provided by their CRM vendor. Call reports identified the top customer service inquiries which the team then used to prioritize their work. Topics were assigned to the SMEs. Using the predefined template, the SMEs quickly built out the online documentation. This is the framework and the start of a database for an automated customer service solution, including a chatbot.
- The company is now expanding the scope for this ad hoc team to continue documenting FAQs and Standard Operating Procedures (SOPs) and expand the knowledge base for their

automated solution. In the meantime, within a few months, customers now have access to the new online documentation.⁴⁹

3.4.4 Getting Started with Gen AI and Customer Service Functions



Source: generated using ChatGPT (OpenAI)

Figure 24: Getting started with Gen AI in customer service

The previous use case illustrates the opportunity to get started with Gen AI without complex systems integration and infrastructure. The company had already invested in a CRM system. Without much additional Information Technology (IT) investment they introduced automated responses to customer inquiries and began laying the foundation for a chatbot.

When considering how to get started with a Gen AI solution for customer service, it is important to follow best practices for transformation projects. A high-level roadmap could include the following steps:

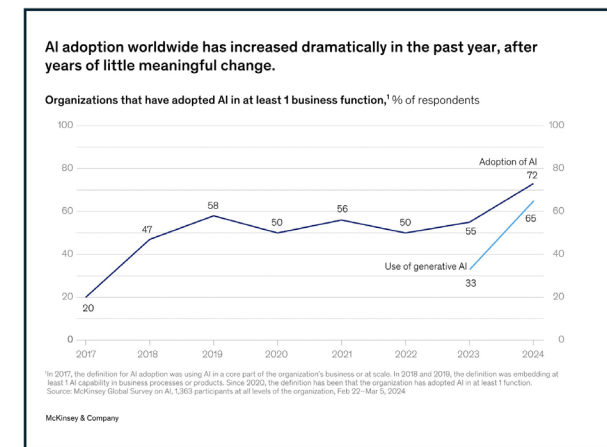
1. **define objectives:** Create a clear, SMART (Specific, Measurable, Achievable, Relevant, Time-Bound) problem statement tied to company goals to guide the project.
2. **assess needs:** Identify repetitive tasks, common inquiries, and service gaps where AI can provide quick wins.
3. **prioritize use cases:** Focus on impactful solutions like chatbots, feedback analysis, or product recommendations that align with business goals.
4. **engage staff:** Train employees to collaborate with AI and

involve subject matter experts (SMEs) early to ensure alignment and reduce resistance.

5. **select tools:** Choose AI tools that fit business needs, leveraging existing platforms or low-cost options for a seamless start.
6. **train AI:** Fine-tune AI models using company-specific data like FAQs, policies, and customer preferences for accurate responses.
7. **integrate gradually:** Roll out AI in customer-facing channels like email, websites, and social media, starting with pilot tests.
8. **iterate and improve:** Continuously refine AI responses based on real-world feedback and monitor metrics to measure success.
9. **scale and celebrate:** Expand successful pilots, track results against objectives, and celebrate milestones to maintain momentum.⁵⁰

Trust, quality, and personalized service are central to the jewelry industry, and Generative AI is revolutionizing how customer service upholds these values. By automating tasks such as inquiries, order tracking and feedback analysis, Gen AI delivers faster, more personalized service while reducing costs. Jewelry manufacturers can begin with small-scale implementations, such as CRM-based chatbots, and gradually expand their use of AI-driven solutions.

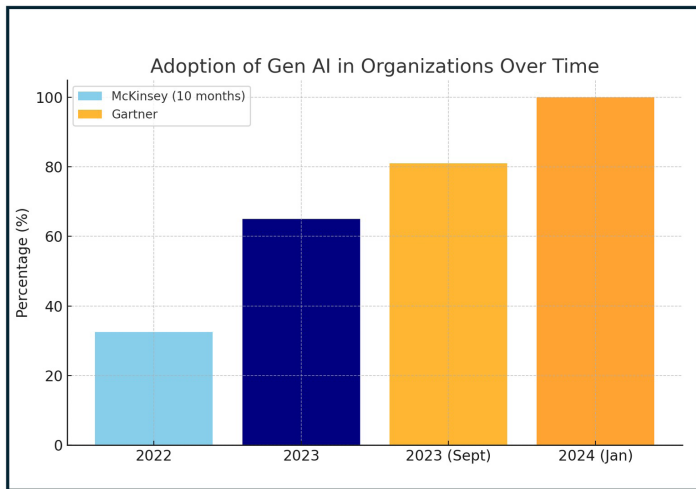
4. GENERATIVE AI AND MARKET OVERVIEW



Source: <https://www.mckinsey.com/capabilities/quantumblack/our-insights/the-state-of-ai>

Figure 25: AI worldwide adoption

Exploring the applications of Generative AI across marketing, design, production, and customer service demonstrates the transformative power of this technology. Market data strongly suggest that Gen AI is not just a passing trend but a disruptive force reshaping industries. As one report notes: “If 2023 was the year the world discovered Generative AI, 2024 is the year organizations began using – and deriving value from – this new technology.”⁵¹



Source: summarized and generated using ChatGPT (OpenAI), derived from McKinsey and Gartner reports highlighted below

Figure 26: McKinsey and Gartner comparative adoption trends

Recent surveys back this claim:

McKinsey: In their latest survey, 65% of respondents reported using Generative AI in their organizations – a near doubling from a survey conducted just ten months earlier.

- 40% indicated they use Generative AI in more than two business functions, with its application predominately in marketing and sales, product and service development and IT. Notably, marketing and sales adoption doubled compared to the previous year.⁵²

Gartner: According to a January 2024 poll, two-thirds of respondents use Generative AI across multiple business units, marking a 19-point increase from September 2023.

- 40% indicate their organizations have deployed Gen AI in

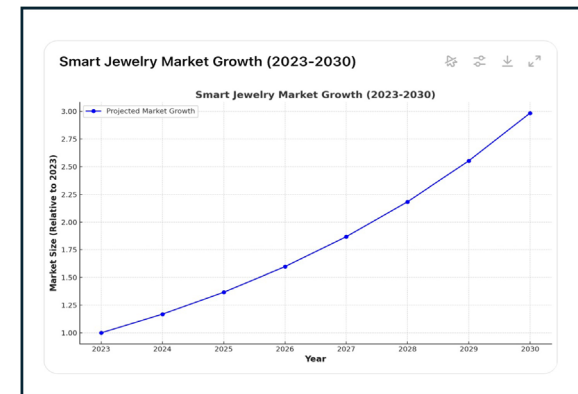
more than three business units: Customer Service (16%), Marketing (14%) and Sales (12%). Gartner also predicts by 2025 Generative AI will be a workforce partner for 90% of companies globally with the key areas of application to include customer service, marketing and IT operations.⁵³

The economic impact of Generative AI is also significant.

- McKinsey estimates that Gen AI could add \$2.6 to \$4.4 trillion in annual global economic value. In manufacturing and supply chains, McKinsey states Gen AI could save up to \$500 billion annually, through efficiency improvements.⁵³
- Global private investments in Gen AI have soared from approximately \$3 billion in 2022 to \$25 billion in 2023, with \$40 billion projected in 2024 and exceeding \$150 billion by 2027.⁵⁴

These market predictions underscore the potential impact Gen AI may have on the business world. For jewelry manufacturers, it could lead to significant cost savings in design, enhanced productivity and expanded customization opportunities.

4.1 Jewelry Industry Market Data



Source: summarized and generated using ChatGPT (OpenAI), derived from Brainvire reports highlighted below.

Figure 27: Smart jewelry growth

Market data and adoption studies for Generative AI specific to jewelry manufacturing are emerging. One study projects the “smart jewelry market is expected to expand at a compound annual growth rate of 16.9% until 2030, indicating a broader trend

towards integrating advanced technologies, including AI, in jewelry manufacturing”.⁵⁵

A survey by Salesforce, a cloud-based CRM software company, and the Retail AI Council indicates that 36% of retail employees are currently using Gen AI, with projections increasing to 45% by 2025.⁵⁶

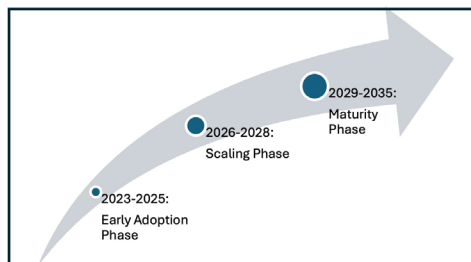
And investments by luxury brands like LVMH in Gen AI startups, Tiffany's investment in the Jewelry Design and Innovation Workshop also indicate a commitment to this technology.

4.2 Generative AI Adoption Projections for the Jewelry Industry

But while precise data is not readily available for jewelry manufacturing, using ChatGPT (Open AI) to extrapolate data from related sectors and marketing trends provides a view into plausible adoption rates for this industry, based on the following assumptions:

- technological progression: Gen AI tools will rapidly improve, particularly in user accessibility and integration with jewelry specific needs.⁵⁷
- cost reduction: Economies of scale in software development will lower entry costs for small manufacturers.⁵⁸
- regulatory landscape: Governments and trade organizations will actively support the safe adoption of Gen AI. ⁵⁹
- consumer demand: Increasing demand for unique, customizable jewelry will drive adoption, especially in higher-income markets.⁶⁰

It is envisioned this adoption will occur over three distinct phases, each with their own unique drivers.



Source: summarized and generated by ChatGPT (OpenAI)

Figure 28: Adoption milestones

1. Early adoption phase (2023 – 2025): Characterized by large, innovative companies and niche jewelry designers with a focus on automating design workflows, generating marketing visuals and rapid prototyping. The key drivers during this phase include technology innovation, competitive advantage and investments in generative models for jewelry-specific applications to enable natural language to CAD-ready designs.⁶¹
2. Scaling phase (2026 – 2028): Characterized by mid-sized jewelry manufacturers adopting the technology as tools become less expensive and more accessible. The direction includes optimization of workflows, including automated stone-setting simulations or assembly plans, customer-facing tools like virtual try-ons and digital catalogs. The key drivers in this phase are cost reduction, proven ROI and workforce augmentation.⁶¹
3. Maturity phase (2029-2035): Characterized by near-universal adoption across the value chain, including small-scale artisans and independent designers. Gen AI becomes a core technology for inventory management, supply chain optimization, predictive sales and market analysis. This phase includes full integration of design-to-production pipelines, for example the ability to link Gen AI based design iterations with production tools like 3D printers. The key drivers in this phase are standardization, comprehensive integration from design ideation to production ready prototypes and culture shift in the work place.⁶²

5. NEXT STEPS



Source: stock images from Microsoft PowerPoint

Figure 29: Leadership and Generative AI

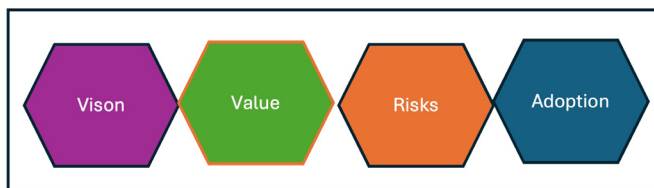
Artificial Intelligence and Generative AI will reshape businesses in ways we cannot yet imagine and is evolving at speeds exceeding past technological advancements. For business leaders, exploration of these technologies should be considered a “must” and not a “maybe”.⁶³

The good news is that Gen AI is still in the experimental phase and readily available tools and offerings meet early user’s needs. Many Gen AI implementations leverage features embedded in software already in use across the company, for example Copilot in Microsoft Word assists in drafting, summarizing and rewriting text based on user prompts and Google Gmail offers smart reply to suggestions, email drafting assistance and personalization assistance.⁶⁴

Starting simple with one step solutions allows an organization to begin their Gen AI journey without significant investment or risk. A McKinsey report found: “Across most industries, roughly half of our survey respondents say they are using readily available, off-the-shelf Gen AI models rather than custom-designed solutions.”⁶⁵

However, even a simple start, such as beginning with a Chatbot, should be framed in the context of a broader strategy. Readily available offerings mean in a short time, these capabilities will be a commodity, “table stakes”, lacking competitive value. Over time, Gen AI company solutions could include off-the-shelf products, customized off-the-shelf products and / or foundation models built from scratch.⁶⁶

Gen AI capabilities cross functional areas: for example, a foundation model trained to reflect the brand’s identity could be applied to marketing and product development. Yet, without a broad-based strategy, siloed technical experiments may lead to “technology for technologies sake”. Stand-alone use cases that randomly sprout up across the business undermine the full potential from approaching Gen AI as a family of use cases.⁶⁶



Source: based on Gartner report- <https://www.gartner.com/en/information-technology/topics/ai-strategy-for-business>

Figure 30: Create an overarching plan

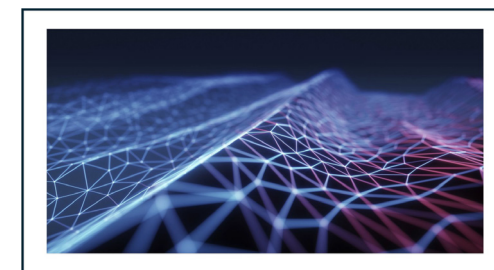
Before embarking on a Gen AI journey, it is important to build an overarching plan for introducing Gen AI into the business operations. Business leaders should decide how they want to approach this technology and then create a strategy. Is there an appetite or driving need to reimagine the workplace and deploy Gen AI to radically transform the business end to end? Start big and reimagine entire workflows? Or is it better to start small by embedding Gen AI into current ways of working and scale later.⁶⁶

There are many studies available to help organizations chart a Gen AI strategy. McKinsey asks their clients to identify their most promising business opportunities and strategies and then work backward to potential Gen AI applications.⁶⁷

Gartner proposes a four-pillar approach. It follows many of the general transformation principles of change projects and includes:

1. Establish your vision for Gen AI: Define how Gen AI will drive business goals, what benefits you expect and how you will measure success.
2. Value: Define what organizational barriers could hinder your success, and what actions are needed to remove these hurdles.
3. Risks: Define what regulatory, reputational, competency, technology and other risks you may need to assess and mitigate.
4. Adoption: Define which are the best Gen AI initiatives to pursue, based on their value and their feasibility – as agreed to by both IT and business leaders.⁶⁷

6. CONCLUSION



Source: stock image from Microsoft PowerPoint

Figure 31: Future of Generative AI

Gen AI has the potential to significantly change jewelry manufacturing. It could have a major impact on everything from precise and hyper-personalized marketing, radical new ways to design and customize products, optimized supply chain and inventory management, enhanced ethical and sustainability practices, streamlined production processes and super effective self-service.

The technology comes with hurdles to overcome. Today, these include data management risks such as data privacy, bias or intellectual property infringement. There are model management risks where the model hallucinates and provides inaccurate responses, and the lack of explainability about how the model derived the response. Sourcing data, managing data, and operationalizing the data can require major investment in IT infrastructure and skills creating a cost barrier for most but the largest companies.

Securing the right talent, training staff, and managing the culture shift underlying the technology requires a disciplined approach. Success for technology driven change requires positive adoption by the users and this is rarely easy.

Generative AI brings a unique set of challenges. Creating clear policies, governance and embedding risk mitigation in the solutions should be part of the company's Gen AI foundation but this also requires specialized skills, education and consistent monitoring.

Yet in spite of these obstacles, Generative AI is on an accelerated path to adoption across all industries. Jewelry manufacturing is no exception. Leaders must decide “how” not “if” to get started on a Gen AI journey. The best approach is to identify where Gen AI capabilities align and drive value with the overall goals and objectives of the business. Regardless of whether to start big and reimagine entire workflows or start small by embedding Gen AI capabilities in existing processes, the main point is to get started and learn through experience.⁶⁷

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