

CUSTOMER GENETIC DATA FOR BUSINESS: EMPOWERING YOUR GENES FOR SUSTAINABLE PRODUCT DEVELOPMENT

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Abstract Recent advancements in genomics have opened up new opportunities for businesses to incorporate customer genetic data into their product and service offerings. From personalized beauty products to individualized music playlists, companies are using genetic data to provide hyper-personalized experiences for their customers. In addition to enhancing customer satisfaction, genetic marketing can also lead to more sustainable and eco-friendly business practices by enabling companies to target their products and services more precisely with fewer resources. However, the use of genetic data also presents challenges related to privacy, ethics, and regulation. This paper aims to explore the opportunities and challenges of integrating customer genetic data for sustainable product development and smart consumption, while also addressing the ethical and regulatory issues that arise with the use of genetic data in marketing.

Keywords:
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1 Introduction

Future survival of businesses depends on the efficient integration of sustainable technologies in marketing and product development. Customer behavior is driven by technology, which accelerates innovation to address sustainability challenges (Gil-Gomez et al., 2020; Drucker & Maciariello, 2008; Bianchi et al., 2022). Customer knowledge is also critical for market survival and growth, and genetic marketing can enable precision targeting and gene-based segmentation considering three categories of factors: (i) environmental factors, (ii) family factors and (iii) customer's genome (Daviet et al., 2022). Recent studies in this field reflect the impact of direct-to-consumer genetic testing (DTC-GT), which have shown to be of a poor predictive value (Martins et al., 2022), and yet it gave rise to novel business models and new market niches on genomic testing market. At the same time, genetic data protection, cyber security and ethical issues in using genetic data for business purposes become even more important with the rise of AI and machine learning. Results from the Genomic Data Governance Survey conducted in the US in 2018 (Briscoe et al., 2020) showed that 50.5% of the American consumers would sell their DNA for \$95. However, the potential of integrating customer genetic data into sustainable product development and consumption practices remains largely unexplored.

This paper aims to address this research gap by exploring the potential of using customer genetic data to drive sustainable product development and consumption practices in businesses. It also highlights the need for better governance of human genetic data to ensure ethical and responsible use. By promoting transparency, data protection, and informed consent, businesses can leverage customer genetic data in a way that benefits both the consumer and the company. As genetic marketing and personalized product development become more common, it is essential to establish clear guidelines and regulations to protect consumer privacy (Deliverska, 2013; Daviet et al., 2022) and prevent discrimination based on genetic information.

2 Consumer Genomics and the New Business Models

Genetic testing has become more accessible to the general public due to significant research and development investments, resulting in genomics becoming a mass market in recent years. Ultima Genomics (2022) claimed to offer sequencing of whole genomes at \$100, compared to the price of \$100 million only two decades

ago. While businesses recognize the transformative potential of genomics (National Human Genome Research Institute, 2021), the accumulation of genetic databases occurs within political, economic, and cultural contexts that reshape them (Burgess, 1999) by bringing forward transformation in consumer behavior patterns and therefore, new business models to respond to these new patterns. Genomics-as-a-service model (GaaS) pushed the emergence of DTC-GT triggered by three types of motivation (Vanhala et al., 2013) for purchase: curiosity, medical needs, or lifestyle factors. GaaS model include comprehensive genomic tests, genomics as part of individual health planning, services based on comprehensive genomic tests, medical precision tests, and restricted trait tests. Yet, a new business model emerged in 2018, in which an individual's genotype is used as a base input for producing personalized material products and services. Panasonic's Genome House project (2019) is such an example, creating living spaces tailored to customers' "DNA preferences". Panasonic's business model places genetic makeup at the core of product development and utilize the human genome as a critical input resource.

3 Behavior Genetics as a Marketing Tool

Behavioral genetics uses quantitative and molecular genetic methods to study the influence of genes on behavior. The field dates back to the work of Sir Francis Galton in the 19th century, who initiated the "nature vs. nurture" debate (Chabris et al., 2015). Behavioral genetics applies a variety of research techniques based on twin studies to learn about the genetic and environmental influences on human behaviour by comparing the traits of biologically and non-biologically related family members (Baker, 2004) to estimate genetic and environmental contributions to behavior. Recent studies in this field suggest that genetic factors may influence entrepreneurial behavior and innovation, as well as specific personality traits related to entrepreneurship, such as risk-taking and willingness to face uncertainty (Kuechle, 2019; Zhao & Seibert, 2006; Kihlstrom & Laffont, 1991; Casson, 1983). Certain proteins linked to these personality traits are affected by genes, and neuropeptides like oxytocin and vasopressin can impact prosocial behavior. Environmental factors can enhance or suppress gene expression, leading to changes in behavior, which is the area of study of epigenetics (Conway & Slavich, 2017). A novel discipline in this field, sociogenomics studies how social and environmental factors interact with an individual's genes and gene expression. It investigates how genes dictate our social

relationships (Beard, 2017) and, for example, whether friends and spouses tend to have similar genetic signature.

However, linking a specific gene to a particular trait is challenging due to the complex nature of the human genome. Gene expression is regulated through polymorphism, which can make it difficult to draw definitive conclusions from research findings (Charney, 2017). Despite the challenges, behavioral genetics has made progress in understanding the influence of genetics on behavior. For example, the "adventure gene" is associated with dopamine production and has been linked to novelty-seeking behavior (Ebstein et al., 1996). However, the complexity of gene expression and regulation means that it is difficult to make definitive conclusions from research findings alone. Nonetheless, the development of new technologies and the continued expansion of genetic testing availability provide exciting opportunities for further exploration into the relationship between genetics and behavior.

4 Sustainable Product Development With Genetic Data

Traditional consumer-centric marketing theory is challenged to revise consumer-centric marketing theory and practice in support of sustainable business operations (Dholakia et al., 2020; Drucker & Maciariello, 2008). Those require systematic innovation and sustainable consumption. On the other hand, innovation and customer knowledge management are essential for meeting customer expectations and improving marketing results, with R&D having a significant impact on a product's resource footprint (Fuchs et al., 2022). Integration of innovative technologies increases chances of success (Muriithi, 2022), backed by a proven positive correlation between innovation, customer involvement, and marketing results (Fidel et al., 2015). Consumers are increasingly adopting circular consumption practices, prioritizing sustainability while primary reasons for not adopting a more sustainable lifestyle are still related to cost, lack of interest in the issue of sustainability and not having enough information (Deloitte-UK, 2022). Thus, it is crucial for businesses to consider sustainability in product development.

Sustainable marketing is about creating and delivering value to customers in a way that preserves natural and human capital (Martin & Schouten, 2014; Peattie & Belz, 2010). It requires a long-term focus and the integration of social and environmental

criteria into conventional marketing processes. Ecodesign, which seeks to fulfill environmental requirements based on SDGs into product development, is a key to a sustainable business strategy (Schäfer & Löwer, 2021; Fuchs et al., 2022). Customer genetic data may be utilized in developing personalized medicine and public health strategies, while behavior genetics can help create goods and marketing efforts that promote sustainable behavior. Epigenetics has the potential to support smart consumption of goods and services by identifying environmental factors that affect gene expression and creating customized dietary and health interventions. On the other hand, sociogenomics may serve as a tool in developing products that encourage sustainable consumption practices through targeted marketing efforts based on genetic and environmental data.

DNA data is a door-opener for nascent customer hyper-segmentation metrics based on hyper-personalization. Machine learning and artificial intelligence now make it possible to identify patterns in consumer behavior and link them to individual genetic markup or cluster of markups in a more precise way. Thus, genetic data may serve as a marketing tool in precision retail (Daviet et al., 2022) and has the power to navigate consumers and educate them to consume smarter in terms of scarce resources and climate changes. For example, companies may develop hyper-personalized products based on individual genetic markup, which would minimize carbon footprint and waste. By integrating customer genetic data as a game changer in product development strategy and corporate social responsibility policies, businesses may improve their brand positioning and support global green transition towards a more sustainable future. However, ethical concerns regarding the use of genetic data, such as potential for discrimination and invasion of privacy should not be overlooked.

5 Genetic Data Privacy and Business Ethics

Incorporating customer DNA-data into a business strategy still raises eyebrows when speaking about data privacy and ethics. Legal framework around the world treats genetic data differently or depending on the specific company's privacy policy, as in the US. Within the European Union, genetic data falls under the scope of GDPR as part of the personal data, and therefore it is protected by law (Consumer Federation of America, 2020). Genomic data management is considered by bioinformatics as big data problem (Reali et al., 2018), which suggests effective

regulatory and software tools for safe storage and sharing to prevent maleficent deeds. With the rise of synthetic DNA technology as a promising data storage solution due to its high-density data storage capacity, longevity, and durability, analogically, it raises significant ethical concerns regarding privacy, security, and potential misuse of sensitive information stored in DNA. Human DNA data has several key features which make it so challenging to handle: (i) immediate identification by a small sample of customer's DNA; (ii) ability to provide information about customer's relatives without their knowledge or consent, and (iii) genetic data does not change over time (Daviet et al., 2022). Customer DNA data as big data may be subject to cyberattacks and discriminatory practices as warrantless surveillance, restricted access to health or other social resources, restricted entry into a country (Deliverska, 2013; O'Doherty et al., 2021) and other intentional and unintentional harms. Primary dangers identified by consumers while providing their genetic data are: (i) denied employment, (ii) provision of unacceptable offers from health insurance companies based on customer's genetic predispositions to diseases, (iii) risk of discrimination in job search and (iv) risk of "identity theft" and of cloning without explicit consent (Briscoe et al., 2020). Moreover, recent studies showed that DTC-GT reports, offered by key market players are not supported by solid scientific evidence and may undermine consumers' trust in general medicine (Delfanti, 2011). Therefore, it is crucial to develop strong ethical guidelines and policies to regulate the use of genetic data for business purposes and protect consumer's privacy rights to promote sustainable product development and to ensure customers that their DNA is safely stored and governed.

6 Conclusion

Authenticity is the top competitive advantage in content management. Genomics can create personalized products and services based on customers' genetic makeup, enabling hyper-personalization. Genomic marketing uses genetic data for profiling and one-to-one segmentation, revolutionizing product development by creating products and services sui generis. Achieving full sustainability is theoretically impossible due to the exponential increase of entropy over time (Ljungberg, 2007; Schäfer & Löwer, 2021). However, businesses can contribute to sustainability by promoting smart consumption and demand for sustainable products and services and positively affect society and the environment. Dr. Francis Collins, director of the National Institutes of Health (NIH), said that "genetics loads the gun, and

environment pulls the trigger." Businesses, as a part of that environment, have a unique opportunity to promote sustainability by educating consumers in smart consumption, encouraging demand for sustainable products and services, and ultimately pulling the trigger in a positive way with the help of genetic data.

Future research could explore new marketing fundamentals that reflect novel models of RFM segmentation to identify new purchasing behavior patterns, observation and analysis of CLTV of DTC-GT consumers and developing a framework for innovation management of DNA-based products and services. All of these would support sustainable product development practices to align with the SDGs, particularly SDG 12: Responsible Consumption and Production. One approach to that might be Schumpeter's *creative destruction* (1950), which describes the process that sees new innovations replacing existing ones that are rendered obsolete over time to tackle innovative practices in response to intense environmental changes. In all cases, genetic data governance should be adequately addressed by legal bodies to ensure consumers' privacy data is well protected, which genetic data extends also to their relatives.

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