



THE RELATIONSHIP BETWEEN CORPORATE SOCIAL RESPONSIBILITY AND FINANCIAL PERFORMANCE: A MODERATE ROLE OF FINANCIAL TECHNOLOGY

By

Dika Fuji Okta¹, Stefani Darmawan², Rimi Gusliana Mais³

^{1,2}Institut Bisnis Indonesia Kwik Kian Gie

³Sekolah Tinggi Ilmu Ekonomi Indonesia Jakarta

Email: ¹dikafuji21@gmail.com, ²sfanidarmawan49@gmail.com, ³Rimi_gusliana@stei.ac.id

Article Info

Article history:

Received July 26, 2024

Revised August 02, 2024

Accepted August 28, 2024

Keywords:

Corporate Social
Responsibility, Financial
Technology, Financial
Performance

ABSTRACT

This research aims to explain the relationship between company's financial performance and corporate social responsibility in the development of financial technology. The method in this research is using a qualitative approach with a literature review method where the data is obtained from relevant secondary data such as trusted journal articles. The results of this research illustrate that financial technology helps company to carry out their social responsibilities, especially in the current digital economic era. Social responsibility that runs well will also improve the performance of the company itself. Although this research is only limited to relevant journal articles, it does not rule out the possibility of collecting other data to support this research. To sum up, integrating corporate social responsibility and financial technology not only has a big impact on society but also improves company's financial performance.

This is an open-access article under the [CC BY-SA](https://creativecommons.org/licenses/by-sa/4.0/) license.



Corresponding Author:

Dika Fuji Okta

Institut Bisnis Indonesia Kwik Kian Gie

Email: dikafuji21@gmail.com

1. INTRODUCTION

As the time goes by, technology also developed. Nowadays, technology not only covered sectors that are related to information and education, but also related with transportation, banking, financial, health and others. In this article, the author will focus on the usage of technology in financial sector or usually called financial technology (*fintech*). Basically, *fintech* is the implementation of technological innovation to improve, speed up and facilitate financial services. The *fintech* concept can be found in the form of e-wallet applications, QRIS, investment, to other online payment and lending applications. For a business or company, development of financial technology can really help to increase the effectiveness and efficiency of managing the company's financial aspects (Leong & Sung, 2018). Apart from that, the implementation of *fintech* can also help company simplify operational processes in order to save time and costs.

One of the business processes that requires the implementation of financial technology is Corporate Social Responsibility (CSR). In the context of CSR, financial technology offers great opportunities for company to design, implement and monitor social programs more effectively. As an important part of modern business strategy, CSR is no longer viewed as a philanthropic activity that is separated from company's core objectives, but rather as an integral part of a company's strategy to create long-term value for shareholders and society as a whole. In addition, financial technology can also help company to allocate resources more efficiently, increase accountability and strengthen relationships with various stakeholders, including customers, investors and communities.

By using digital financial technology, company can reach community groups that are difficult to reach with traditional financial services, for example people who live in remote areas and have limited internet networks. Technology such as digital payments, blockchain, and crowdfunding platforms provide new opportunities for companies to carry out CSR projects more innovatively and able to reach a wider community.

For example, crowdfunding platforms allow people to participate directly in social projects through online donations (Florez-Parra, Martin, & Serrano, 2020). Because of the unlimited internet access and the wide dissemination of information, the public is becoming increasingly aware of current social projects that are needing donation (Linardi & Nur, 2021). Apart from that, the use of blockchain technology can also help company to ensure transparency in the distribution of CSR funds. In this way, company can increase public trust in the institutions and CSR programs concerned (Ezzi, Jarbouli, & Mouakhar, 2022).

Integrating *fintech* and CSR also provides benefits for company in terms of data management and reporting. Technology that allows real-time data collection can help company to track and evaluate the impact and benefits of the CSR program more easily. This allows company to adjust programs based on accurate data, while providing more transparent reporting to stakeholders regarding the progress and results of the CSR program. Therefore, the implementation of *fintech* not only can strengthen the social impact of CSR, but can also help company improve the efficiency and effectiveness of business operations, as well as improve CSR administration and management processes.

Several large companies have successfully integrated financial technology into their CSR strategy. This helps the company not only have a positive impact on society, but also improve the company's financial performance. Some examples of companies that have successfully implemented fintech in CSR programs are Ant Financial by Alibaba Group, Paypal and GoPay by Gojek.

Ant Financial is a subsidiary of the Alibaba Group which owns the electronic payment method Alipay, Ant Financial has utilized financial technology to launch various CSR initiatives, one of which is the 'Ant Forest' campaign. Through this program, Alipay users can participate in various activities to prevent environmental damage, such as tree planting efforts, earning points that can be exchanged for certain products if users walk or use public transportation, and so on (Nunez-Barriopedro, Cuesta-Valino, & Yang, 2023). This initiative not only contributes to environmental preservation, but also increases user loyalty to the Alipay platform and strengthens Ant Financial's financial position.

PayPal is an example of another company that has successfully integrated *fintech* to support various social programs, one of them is an online fundraising platform. By integrating *fintech* in its CSR fundraising programs, PayPal makes it easier for users to donate easily and quickly to various non-profit organizations via websites and applications (Sirisawat, Chatjuthamard, Kiattisin, & Treepongkaruna, 2022). The integration of *fintech* with CSR crowdfunding has not only had a positive impact on the various community targeted for assistance, but has also succeeded in strengthening the company's brand image and reputation as an ethical and responsible financial service provider. In this way, PayPal will be able to increase customer trust and strengthen its competitiveness in the global market.

Not only international companies, but companies from Indonesia have also succeeded in implementing *fintech* into the implementation of CSR programs. One example of a company from Indonesia that has been successful is GoPay which operates under the parent company Gojek. GoPay supports digital donations to various charities and social programs through the "GoPay for Good" program. This program helps GoPay users to make donations directly from the Gojek application without going through a complicated process (Hastuti, 2019). This initiative not only supports the creation of inclusive socio-economic conditions in Indonesia, but also increases the use and popularity of GoPay services.

The three examples above show that the integration of *fintech* and CSR not only has the potential to have a positive impact on society and the environment, but also improves the company's financial performance. By implementing *fintech* to develop innovative CSR solutions that bring many benefits, company can strengthen customer relationships, improve reputation and brand image, and ultimately create sustainable economic value. From the explanation above, this article will explain about the relationship between the Corporate Social Responsibility (CSR) program and the company's financial performance with financial technology as a moderating factor.

2. LITERATURE REVIEW

1. Corporate Social Responsibility (CSR)

Corporate Social Responsibility (CSR) basically emphasizes the function of a company that is not only focused on making profits, but also actively seeks to have a direct positive impact on society and the environment. Some experts define CSR as a series of practices carried out by company to contribute to broader social, economic and environmental welfare without ignoring financial goals (Sheehy, 2015). This definition reflects an approach that involves several stakeholders simultaneously. This means that company is not only responsible to shareholders, but also to employees, customers, communities and the environment.

According to Carroll (1991), CSR consists of four levels of responsibility, including economic, legal, ethical, and philanthropic responsibilities. First, economic responsibility refers to a company's obligation to generate profits as the basis for sustainable business operations. Second, legal responsibilities include

our compliance with applicable laws and regulations. Third, ethical responsibility refers to the actions of an entrepreneur which must reflect the social and moral norms that apply in society. Finally, philanthropic responsibility is a company's efforts to contribute voluntarily to society, such as donations, philanthropy and community development programs.

In implementing CSR, company often focus on issues such as environmental sustainability, fair labor practices, gender equality, and strengthening local communities. CSR itself basically aims to create a positive impact in a sustainable manner, both for the company itself, as well as for the people and communities that are the targets of the program. By practicing CSR, company can improve its reputation, increase customer loyalty, and build better relationships with various stakeholders. Apart from that, well-managed CSR can also help company to reduce social and environmental risks and ensure long-term business sustainability.

2. Financial Technology

As has been briefly explained in the introductory subchapter above, financial technology (*fintech*) refers to the application of technological innovation to improve financial services (Leong & Sung, 2018). This includes all forms of innovation aimed at providing financial solutions that are faster, more accessible and more transparent than traditional financial services. In general, financial technology includes platforms that serve digital payments in the form of e-wallets or mobile banking, blockchain to implement secure transactions, crowdfunding for social fundraising, peer-to-peer loans or P2P lending, and so on (Dharmadasa, 2021).

The presence of *fintech* has expanded access to financial services to groups that were previously marginalized or had difficulty getting internet access, such as people in rural areas. Therefore, financial technology plays an important role in accelerating financial inclusion, which is also in line with CSR goals to achieve broader social impact. However, *fintech* not only offers advantages in financial inclusion, but also increases transparency in fund management and CSR programs. For example, blockchain technology allows company to verify the use of CSR funds more accurately, thereby increasing accountability and trust among stakeholders (Ezzi, Jarbou, & Mouakhar, 2022).

Another example is crowdfunding platforms which provide opportunities for company to involve the community directly in funding social projects. These technological advances allow company to build stronger relationships with customers through a more collaborative and participatory approach (Florez Parra, Martin, & Serrano, 2020). Furthermore, financial technology also enables company to manage their CSR programs more effectively through real-time data collection and analysis. By collecting data across digital channels, company can have a better measurement for its CSR impact and make program adjustments quickly and accurately to maximize results. In this way, financial technology not only increases operational efficiency in implementing the company's CSR, but also ensures that the CSR programs will be able to have a direct impact on the target community groups.

3. Financial Performance

The financial performance of a company is usually measured using a series of financial indicators or ratios to evaluate the effectiveness and profitability of the company's operations. Commonly used metrics include return on assets (ROA), return on equity (ROE), profit margin, and sales growth.

a. Return on assets (ROA)

Return on Assets (ROA) is a financial ratio that measures the efficiency of a company in using its assets to generate profits. Through ROA calculations, companies can determine how much net profit the company generates with each unit of business assets owned and used (Batchimeg, 2017). The higher the ROA value, the more efficient the company is in using its assets to generate profits. ROA can be calculated using this formula:

$$ROA = \frac{\text{Net Profit}}{\text{Total Asset}} \times 100\%$$

b. Return on equity (ROE)

Return on equity (ROE) is a financial ratio that measures the amount of profit a company obtains from its investment or shareholder capital. ROE reflects how effectively a company uses capital invested by shareholders to generate profits. A high ROE indicates that a company uses its capital more efficiently to generate profits for shareholders (Batchimeg, 2017). ROE can be calculated using this formula:

$$ROE = \frac{\text{Net Profit}}{\text{Shareholders' Equity}} \times 100\%$$

c. Profit margin

Profit margin or profit margin is an indicator that measures how much profit a company obtains from the revenue it generates. This metric will show the percentage of each sale that is net profit after deducting all costs. There are two types of profit margin calculations that are commonly used, namely gross profit margin and net profit margin (Batchimeg, 2017).

i. Gross profit margin

Measures how much profit is generated after deducting direct production costs from sales. Gross profit margin can be calculated using this formula:

$$GPM = \frac{\text{Gross Profit}}{\text{Revenue}} \times 100\%$$

ii. Net profit margin

Measures how much income is generated from sales after deducting all operating costs, taxes and interest. Net profit margin can be calculated using this formula:

$$NPM = \frac{\text{Net Profit}}{\text{Revenue}} \times 100\%$$

3. RESEARCH METHODOLOGY

1. Research Type

This research uses a qualitative approach based on a literature review to understand the impact of financial technology on CSR implementation and company financial performance. This approach is suitable for analyzing various existing literature sources regarding the use of financial technology in CSR, as well as the impact of financial technology on company financial performance. This research uses theoretical research and secondary data from academic articles, books and other relevant documents to identify patterns and significant relationships between the variables studied. Literature review techniques allow researchers to collect and analyze relevant information from a variety of widely available sources, while providing a strong theoretical basis for understanding the relationship between CSR, *fintech*, and corporate financial performance. Thus, this research aims to integrate existing knowledge and identify gaps in previous research to provide new insights into the topic under study.

2. Data Collection Method

Data collection in this literature review-based research was carried out by collecting relevant secondary literature from various trusted sources. The literature search was carried out through academic databases such as Google Scholar to find journal articles, research reports and other relevant documents, using keywords such as *fintech*, CSR, financial performance, technology-based CSR implementation, and impact of financial technology. After the initial search, the literature found will then be selected according to its relevance to the research topic and the quality of the source. The author only uses articles published in trusted journals and scientific books with a strong theoretical basis as references for carrying out further analysis. By using a literature review as a data collection method, relevant information can be collected from various valid and reliable secondary sources to study the phenomenon.

3. Research Analysis Method

After all the required data has been collected, the next step is to analyze the data using content analysis techniques. This method focuses on identifying patterns and themes that emerge in the literature reviewed. The analysis process is carried out by identifying similarities, differences and relationships between literatures. This process was carried out to gain more comprehensive understanding of the role of financial technology in CSR practices, as well as its impact on financial performance. Next, a critical assessment of the literature used was carried out. This process includes an evaluation of the research methods used in previous studies, the relevance of the results, as well as the strengths and weaknesses of each literature source. The goal of this process is to provide a deeper and more objective perspective on existing research findings and to identify research gaps that may represent opportunities for future research. By using this analytical method, this research not only provides an in-depth understanding of the role of financial technology in CSR, but can also explain how technological innovation, especially *fintech*, can contribute to community welfare and sustainable business economic growth.

4. DISCUSSION

1. The Influence of Fintech on the Implementation of Corporate Social Responsibility

Financial technology (*fintech*) has revolutionized the way company implement Corporate Social Responsibility (CSR) programs. *Fintech* innovation itself can help company to expand the scope of CSR programs, increase efficiency, and ensure accountability and transparency in all program initiatives undertaken. In fact, the impact of



fintech on CSR includes increasing efficiency, transparency and accountability. These three things are important variables for effective CSR implementation.

i. *Financial Technology as a Driver of Efficiency in CSR Implementation*

Efficiency here refers to a company's ability to use resources optimally in its CSR programs to achieve maximum social impact at minimum cost. Financial technology has made a significant contribution to increasing the efficiency of CSR programs, including through the use of automated technology in the donation process and financing of social projects. *Fintech* platforms such as crowdfunding allow company to connect donors and investors directly with the social projects they support, without the need for traditional intermediaries, thereby reducing administrative burdens. The efficiency achieved through the use of *fintech* also includes the time and energy required to manage CSR programs. Digital platforms enable companies to implement CSR campaigns in real time and monitor project progress and results more quickly. Digital payment technology also enables instant transfer of donations and social assistance, thereby increasing the speed of resource distribution and implementation of social programs.

ii. *Financial Technology Expands Scope of CSR Programs*

Fintech not only increases efficiency but also expands the scope of CSR programs. In CSR theory, reach refers to how wide the impact of a company's social initiatives is and how many stakeholders are involved (Pristi & Bandiyono, 2024). *Fintech* platforms like crowdfunding enable businesses to reach a wider audience in different parts of the world. Through *fintech*, company can involve local and global communities to support social initiatives, thereby increasing community participation in CSR implementation. For example, a company can launch a CSR campaign that utilizes crowdfunding techniques. This campaign allows the wider community to participate by donating money to support social and environmental projects. This not only increases people's access to CSR programs, but also strengthens their involvement, because the transparency of financial technology allows them to directly monitor the results of their contributions. In theory, this broader stakeholder involvement increases the company's legitimacy and credibility in the eyes of society.

iii. *Increasing CSR Transparency and Accountability by Financial Technology*

Transparency and accountability are two other important variables that are increasingly strengthened by *fintech* in implementing CSR. Basically, transparency can be interpreted as the company's openness to stakeholders regarding the objectives, processes and results of the CSR activities carried out. Accountability, on the other hand, refers to a company's responsibility to report and be responsible for the impact of its social actions (Lubis, Mais, Ardheta, Mulyati, & Maliki, 2024). By using blockchain, company can provide practical solutions to increase CSR transparency and accountability. Blockchain allows all transactions and contributions in CSR programs to be recorded in a storage system that can be accessed and independently verified by the public. This ensures that every donation and social investment is used appropriately and not misused. This technology also allows all parties involved, including companies and other stakeholders, to track the progress of CSR projects from start to finish. This increased transparency contributes to increasing public trust in companies, which is a key element of CSR success.

2. The Influence of Financial Technology on Company Financial Performance

The use of *fintech* in implementing CSR programs not only has a positive impact on society, but also contributes significantly to improve the company's financial performance. There is a relationship between financial technology and company financial performance that can be analyzed through several important variables, namely operational efficiency, customer loyalty, brand reputation and competitive advantage.

i. *Optimization of Resource Utilization*

Operational efficiency is one of the key variables that allows financial technology to play a role in improving a company's financial performance. By using *fintech*, companies can minimize the use of resources, both in terms of administrative effort and time spent implementing programs. In addition, digital payment technology allows funds to be distributed quickly and efficiently. This not only helps company to save time, but also reduces the chances of delays in implementing social projects. This efficiency will directly impact cost savings, which can increase the company's profit margin.

ii. *Increased Customer Loyalty*

Customer loyalty is another variable that contributes directly to improving a company's financial performance. Previous research shows that company that emphasize social responsibility often achieve higher levels of customer loyalty, especially when CSR programs are supported by technology that encourages customer engagement (Adrai & Perkasa, 2024). With *fintech* integration, the company provides opportunities for customers to actively participate in the company's CSR initiatives through digital donation platforms and other CSR applications, thereby increasing their sense of ownership and emotional connection to the brand. When customers feel an emotional connection with a brand, customers are more likely willing to make consistent purchases.

iii. *Brand Reputation and Competitive Advantage*

Apart from customer loyalty, increasing brand reputation is also an important variable that helps improve the financial performance of companies that integrate *fintech* and CSR. Basically, brand reputation is often associated with increasing consumer preferences and market competitiveness. This improved reputation allows the company to attract more customers and business partners and improve access to capital. Additionally, the competitive advantage gained from a strong reputation not only helps companies gain market share, but also allows companies to command premium prices for products and services based on the value created by social engagement. *Fintech* plays an important role here by increasing transparency in CSR practices, as well as strengthening positive perceptions of companies among the public. When consumers believe that a company has the integrity to have a positive impact on the environment and social community, customers will tend to have a good perception of the company, thereby ultimately increasing the company's competitiveness in the market.

3. The Influence of Financial Technology on the Implementation of Corporate Social Responsibility and Company Financial Performance

Effective CSR implementation can influence a company's financial performance through various mechanisms. First, good CSR can improve a company's reputation, thereby attracting more customers and increasing loyalty. This is because several studies have found that consumers are more likely to choose products and services from companies that are known for their social contributions (Perkasa & Sunaryo Putra, 2020). Second, CSR efforts integrated into financial technology can help company in reducing operational costs through more efficient resource management. For example, the use of digital technology to manage donations and social activities can reduce administrative burdens, increase transparency, and produce greater cost efficiencies.

In addition, the integration of fintech and CSR creates new opportunities for company to generate additional income by developing digital-based financial services that support social inclusion. Company that use financial technology to practice CSR can not only act as agents of social change, but also benefit from new market segments provided by financial technology innovation. For example, microcredit services and crowdfunding platforms designed to support small and medium enterprises (MSMEs) can support national economic development (Prabantoro, et al., 2024). Overall, the positive impact of the integration of fintech and CSR is not only limited to achieving social goals, but also improving the company's financial performance through increasing customer loyalty, reducing operational costs, and creating new business opportunities. Furthermore, company that strategically integrate CSR implementation with *fintech* can gain sustainable competitive advantages in the international arena.

5. CONCLUSION

Integrating financial technology and CSR not only brings greater social benefits, but also creates a positive synergy between social responsibility and corporate financial performance. This research finds that *fintech* acts as a connector that facilitates the realization of shared value resulting from a combination of social and financial impacts. In this way, company can achieve greater economic benefits by focusing on developing solutions to social problems faced by business customers. *Fintech* innovation allows company to design more effective and efficient business strategies based on emerging social problems, so that company can increase their competitiveness.

By supporting accountability, transparency, operational efficiency and customer loyalty, *fintech* not only increases the social impact of CSR but also strengthens the company's financial performance. Therefore, from the results of the analysis presented above, it can be concluded that financial technology is the key element in the synergy between CSR programs and financial performance, which is able to contribute to sustainable business growth and create long-term benefits for business and society.

REFERENCES

- [1] Adrai, R., & Perkasa, D. (2024). Penerapan Etika Bisnis dan Tanggung Jawab Sosial Perusahaan Dalam International Human Resources Management. *Jurnal Manajemen & Bisnis Madani*, 6(2). doi:<https://doi.org/10.51353/jmbm.v6i2.950>
- [2] Batchimeg, B. (2017). Financial Performance Determinants of Organizations: The Case of Mongolian Companies. *Journal of Competitiveness*, 9(3), 22-33. doi:10.7441/joc.2017.03.02
- [3] Carroll, A. (1991). The pyramid of corporate social responsibility: toward the moral management of organizational stakeholders. *Business Horizons*, 34(4).
- [5] Dharmadasa, P. (2021). "Fintech Services" and the Future of Financial Intermediation: A Review. *Sri Lanka Journal of Economic Research*, 8(2). doi:<https://doi.org/10.4038/sljer.v8i2.135>
- [6] Ezzi, F., Jarboui, A., & Mouakhar, K. (2022). Exploring the Relationship Between Blockchain Technology and Corporate Social Responsibility Performance: Empirical Evidence from European Firms. *Journal of the Knowledge Economy*, 14, 1227-1248.



- [7] Florez-Parra, J., Martin, G., & Serrano, C. (2020). Corporate Social Responsibility and Crowdfunding: The Experience of the Colectual Platform in Empowering Economic and Sustainable Projects. *Sustainability*, 12(13). doi:<https://doi.org/10.3390/su12135251>
- [8] Hastuti, R. (2019, Desember 19). *Teknologi GoPay Makin Jadi Andalan untuk Pengumpulan Donasi*. Retrieved from CNBC Indonesia: <https://www.cnbcindonesia.com/tech/20191219111401-37-124356/teknologi-gopaymakin-jadi-andalan-untuk-pengumpulan-donasi>
- [9] Leong, K., & Sung, A. (2018). FinTech (Financial Technology): What is It and How to Use
- [10] Technologies to Create Business Value in Fintech Way? *International Journal of Innovation, Management, and Technology*, 9(2), 74-78.
- [11] Linardi, C. ., & Nur, T. . (2021). Faktor-Faktor Yang Mempengaruhi Minat Mahasiswa Berdonasi Melalui Platform Crowdfunding. *INOBIIS: Jurnal Inovasi Bisnis Dan Manajemen Indonesia*, 4(2), 249 - 267. doi:<https://doi.org/10.31842/jurnalinobis.v4i2.181>
- [12] Lubis, M., Mais, R., Ardheta, P., Mulyati, A., & Maliki, F. (2024). Analysis of Accountability and Transparency in the Management of School Operational Assistance Funds. *Taxation and Public Finance*, 1(2), 83-94. doi:<https://doi.org/10.58777/tpf.v1i2.243>
- [13] Nunez-Barriopedro, E., Cuesta-Valino, P., & Yang, Y. (2023). Corporate Social Responsibility of “Ant Forest”: Ant Group’s “Internet + Tree Planting” Public Welfare Project. In *Responsible Consumption and Sustainability* (pp. 119-133). New York: Springer.
- [14] doi:https://doi.org/10.1007/978-3-031-30742-3_7
- [15] Perkasa, D., & Sunaryo Putra, W. (2020). Peran Kualitas Pendidikan, Biaya Pendidikan, Lokasi dan Citra Merek dalam Mempengaruhi Minat Siswa Memilih Perguruan Tinggi XYZ.
- [16] *Seminar Nasional Pendidikan PPs* (pp. 72-87). Palembang: Universitas PGRI Palembang.
- [17] Prabantoro, G., Mais, R., Megayani, M. M., Ardheta, P., Faruqi, F., Anthonio, D., . . . J Siwu, H. (2024). Digital Marketing Optimization: Empowering Market Growth for MSMEs in
- [18] Kahuku Village, East Likupang. *Entrepreneurship and Community Development*, 2(1). doi:<https://doi.org/10.58777/ecd.v2i1.226>
- [19] Pristi, K., & Bandyono, A. (2024). Tren dan Pola Dalam Adopsi Standar Pelaporan Global Reporting Initiative (GRI) Oleh Perusahaan BUMN di Indonesia: Scoping Review. *Indonesian Accounting Research Journal*, 4(3). doi:<https://doi.org/10.35313/iarj.v4i3.6110>
- [20] Sheehy, B. (2015). Defining CSR: Problems and Solutions. *Journal of Business Ethics*, 131, 625- 648. doi:<https://doi.org/10.1007/s10551-014-2281-x>
- [21] Sirisawat, S., Chatjuthamard, P., Kiattisin, S., & Treepongkaruna, S. (2022). The future of digital donation crowdfunding. *PLOS ONE*. doi:<https://doi.org/10.1371/journal.pone.0275898>

THIS PAGE IS INTENTIONALLY LEFT BLANK