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# CHAPTER X

# Environmental Transformation and AI: implementing Catholic Teaching on Ecology

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**Abstract**

Artificial intelligence or AI technology advances have great potential to transform efforts to preserve the environment. However, its implementation requires a foundation of ethical or moral values to be useful for ecology and humanism. The fundamental principles of Catholic Church doctrine, such as the dignity of the human person, social justice, and responsibility for the environment in which we live, are relevant to be integrated into the development and regulation of AI for the environment. Transparency, accountability, privacy, equality and sustainability are the main standards. Apart from that, risk analysis, stakeholder participation, and applying the principle of do no harm or do no harm are important to be put into practice to ensure that AI does not damage the ideals of ecological and humanitarian protection. In this way, AI can positively transform the environment towards a more sustainable future.

**Keywords:** AI Ethics, Catholic Principles, Dignity of life, Social and environmental responsibility

## Introduction

The threat of a climate crisis and environmental damage has become a pressing issue worldwide. According to a UN report (Kusuma & Ida Hamidah, 2022), the earth has lost over 80% of its natural habitat in the last 50 years. In facing this global challenge, artificial intelligence has great potential to contribute to environmental conservation and restoration efforts. However, implementing AI requires a responsible approach and is based on ethical principles so that it does not negatively impact. According to Schwartz (2022), one of the risks is neglecting human responsibility towards nature if they completely depend on independent AI

systems. Therefore, every AI implementation initiative related to the environment needs a strong ethical framework.

In this context, Catholic social teachings provide relevant moral principles, such as the dignity of life, solidarity, justice and subsidiarity (Franz, 2022). By integrating these Catholic ethical guidelines, it is hoped that AI can truly transform environmental protection efforts for the benefit of all humanity. While Catholic ethical principles are promising, a major challenge is implementing them into the development and application of AI for the environment. One criticism is that moral teachings are often too abstract and difficult to translate into concrete actions (Camosy, 2022). Therefore, systematic efforts are needed to relate these principles to various stages of the AI life cycle, from data collection and algorithm modeling to system implementation and evaluation.

According to Lim (2023), the integration of ethical principles into AI can be done through several strategies, such as algorithm audits, interdisciplinary research, and the involvement of various stakeholders. Algorithm audits are important to ensure there is no bias in the data or logic of the AI system, which could result in discrimination.

Interdisciplinary research is needed so that AI ethics is not only dominated by a technical perspective but also includes philosophical and socio-cultural views. Meanwhile, the involvement of stakeholders, from government, scientists, and environmental activists to indigenous communities, can ensure that local needs and values develop AI.

Another strategy that is no less important is increasing data and algorithm literacy among the general public. Currently, many AI systems, including those applied to environmental issues, are seen as black boxes that are difficult for the public to understand (Chui et al., 2023). This condition is vulnerable to data misuse, algorithm manipulation, and privacy violations, which are counterproductive to efforts to preserve the environment itself. Therefore, building community capacity regarding AI ethical principles needs to receive adequate attention to achieve digital justice.

Departing from the description above, the question asked in this paper is: How to design an AI ethical framework for environmental preservation based on Catholic principles, which can be effectively applied in various environmental-related AI system development and implementation initiatives?

## Literature Review

### The role of the Catholic Church in environmental conservation

The Catholic Church wants to participate in efforts to preserve the environment in which all creatures live. This statement is expressed in the teachings of the Church, especially the official teachings of its leader, Pope Francis. This was revealed in the Encyclical on the Environment, Encyclical Laudato Si' (2015). In his crucial teachings for the current technological age, Pope Francis firmly asks all Catholics and all people of goodwill to participate in efforts to protect nature and the environment in which humans live and live. The Pope made a clear call: Living our vocation to be protectors of God's handiwork is essential to a life of virtue; it is not an optional or a secondary aspect of our Christian experience (Pope Francis, 2015).

For Christians, this is a duty or obligation and a calling. Christians are called to play a role and be active in the ecological crisis that threatens and disrupts the order of creation. Answering this call became integral to his identity as a Christian. It means that a person is called a Christian if he takes part in this call to affirm his identity as a Christian. Because it is so important, caring for the environment is not just a choice but a command; it has become a religious obligation. With this, the Church must carry out a leadership role by setting an example, not just as a giver and creator of opinions. This was confirmed by McDonagh (2022).

The participation of Catholics in protecting the environment is actually by what the Holy Bible teaches to protect and care for the garden (Gen. 3:15) where they and other creatures live. This is continued by the Catholic tradition, which has long paid attention to nature conservation. The Second Vatican Council in 1965 even touched on human environmental responsibility in Gaudium et Spes's document. Thus, being actively involved in anti-environmental destruction is the spiritual calling of every devout Christian, especially Catholics. According to McDonagh (2022), The Church needs to take a leading environmental role in climate. This relates to issues of social justice, where the small and weak are most vulnerable to the effects of global warming. (McDonagh, 2022, p. 57). With this, the Catholic Church has a moral responsibility for the climate crisis that is currently hitting the world.

In this regard, Pope Francis also firmly underlined the role of the Church in Laudato Si': I hope that this Encyclical contributes to the development, with freedom and awareness of responsibility, of the urgent and radical solutions necessary to overcome one of the devastating ecological crises. (Pope Francis,

2015, #141). According to Schwartz (2022), the Encyclical Laudato Si is one of the radical teachings of the modern Church regarding the liberation of humans and nature from exploitation by certain destructive parties.

## The Role of Artificial Intelligence in Environmental Conservation

Artificial intelligence (AI) is an important technology to address environmental challenges and climate change. Through its ability to analyze data on a massive scale and complex patterns quickly, AI can assist humans in efforts to conserve nature, protect wildlife, monitor carbon emissions, optimize building energy, and predict and adapt to climate change. An article by Das et al. (2023) reveals various applications of AI in the environment: AI can help in pollution monitoring, weather and climate forecasting, building energy optimization, product life cycle analysis, and sustainable agricultural decisions. (Das et al., 2023, p. 2)

According to research from Arakelyan et al. (2022), AI systems have been used for mapping and identifying animal habitats, detecting invasive species, hydrological analysis for water conservation, optimizing electric vehicle routes to reduce CO2 emissions, and helping the agricultural world in fertilizing crops and irrigating agricultural land effectively and efficiently. AI's ability to translate data in the environment into important information enables monitoring and environmental analysis on a large scale and precisely.

However, Markus and Kietzmann (2023) emphasize the other side of AI. AI itself needs to be developed vigilantly and carefully not to create negative consequences such as algorithm bias and violations of privacy and fairness. Designers and organizations must ensure that AI is aligned with the principles of fairness, accountability, privacy, and security so that it can provide benefits to society, especially for long-term goals for society and the environment (Markus et al., 2023, p. 8). Adoption and application of AI without ethical considerations and deep human values risks giving rise to new problems in society.

## Applying Catholic Principles in AI Governance

In a book entitled Governing Artificial Intelligence Towards a Just Digital Transition, Vogl (2022) believes that the application of AI requires global governance based on human values. He advocates that several principles, such as transparency, accountability, privacy, and public participation, must be integrated into AI regulations to bring progress in the true sense rather than bringing disaster to humans.

The principles above align with what is stated in the Church's social teachings, which emphasize human dignity and social justice. According to Luciano Floridi, in a Newsweek opinion article (2022): The development and application of new technology such as AI must always consider the impact on each other and the environment around us, not just for financial gain or power. (Floridi, 2022). This idea is in line with the call of Pope Francis (2022) in his speech on AI ethics at the Vatican: Algorithms and AI technology must not be used to exacerbate social inequalities between people and weaken inclusive democracy. (Vatican News, 28 February 2022)

From the views above, it is clear that the Catholic Church emphasizes the importance of global ethical standards in developing and implementing AI. The fundamental values of Catholic moral teachings, such as justice, inclusion, integrity, solidarity, and sustainability, must be the basis of every policy and practice related to AI so that this technology truly upholds civilization instead of causing dehumanization or new ecological and social crises.

**Ethical Challenges of Artificial Intelligence**

The extraordinary rapid development of AI triggers various ethical challenges that must be overcome as early as possible. Experts and researchers have widely discussed problems such as algorithm bias, social injustice, dehumanization, and losses caused by AI systems. Francis (2023), in the journal Establishing Ethics of Care in AI Development, puts forward a utilitarian ethical approach that is often applied but is not enough to answer the problem. Therefore, a universal ethical framework is needed with an emphasis on humans and society so that AI can benefit humans.

Pope Francis (2022), at the Vatican Conference on the Morality of Artificial Intelligence, issued a warning about the dangers of AI systems developed without prioritizing human values: Intelligent algorithms that are not open and personalized can exacerbate social injustice, erode democracy, and even violate the dignity of the human person. (Pope Francis, 2022). The rapid development of AI and its application in various areas of life has triggered new questions and problems related to ethics. Some challenges that are often discussed in contemporary scientific literature are:

Potential bias or prejudice embedded in machine learning algorithms that will influence AI results and decisions. According to research by Zou and Schiebinger (2018), AI systems can produce gender and racial biases from their

training data. AI raises the risk of job losses and reduces human autonomy. AI risks creating more unemployment than before and can create dehumanization. According to Francis et al. (2022), A society ruled by algorithms without the presence of human ethics will lose its identity and human values. AI can potentially violate the confidentiality or privacy of its users' personal information because it collects and analyzes large amounts of data. According to Jobin et al. (2019), this can create manipulation and misuse of data by irresponsible parties.

The problems mentioned above reveal the urgency of integrating ethical considerations and decisions with humanist values into the development of AI technology so that it provides benefits rather than destruction for humanity. Without sufficient ethical insight, the application of AI could have negative consequences for equality, freedom and human dignity.

**Application of the Do No Harm Principle in AI for the Environment**

The principle of 'do no harm' or do no harm is important in developing all technology, including AI, for the environment. The principle of 'no harm' is a fundamental ethical guide in developing any technology, including AI, for the environment. The principle above prioritizes thoroughly evaluating a system's potential and negative consequences before the technological results are implemented in a society. In other words, this principle requires AI developers to prioritize a thorough analysis of the effects or consequences and minimize potential losses in a system.

In an editorial for Juenal Science, Shneiderman (2023) emphasized that AI implementation needs to begin with risk analysis, carried out with stakeholders, and committed to continuous evaluation and improvement so that the do no harm principle is truly implemented. Furthermore, structuring the AI system must ensure human accountability, algorithm auditability, and a path for recovery if errors are detrimental to its users. According to Floridi (2022) in his work, Regulating Artificial Intelligence says very clearly:

AI can be a very useful instrument of assistance, but humans must remain in control and responsible for the consequences of any artificial intelligence system. (Floridi, 2022, p. 105). In other words, a do-no-harm principle-based approach requires responsible AI design and the principle of 'prevention is better than cure.' Only then can AI technology be guaranteed to provide real benefits to humanity, not the other way around

## Discussion

### The Role of the Catholic Church in Saving the Environment

As a religious institution, the church has an important role and responsibility to save the environment from its situation, which is becoming increasingly critical daily. The role that the Church takes is primarily a moral role. According to CcDonagh (2022: The climate crisis is a fight to defend human life and dignity. Therefore the Church must be at the forefront of this effort, not just wait and regret the damage. The Church is the Church in the world if she cares about the environment in which she lives. The environment is a common home in which everyone lives. In the encyclical Laudato Si, Pope Francis (2015) also reminded religious people to be concerned about this 'common home': I invite everyone with appreciation to respond to the cry of the earth and the cry of the poor.

This role and calling is not only called for by the official leader but also finds its basis in the Holy Bible (Genesis 2:15). Humans are called to be guardians and guardians of the environment or the earth created by God. For Pope Francis (2015), the earth is not just land or a garden but has become a home. Because it has become a home, anyone who is a member of the Church and everyone with goodwill must guard and protect it. The Pope emphasized that this Earth is our common home and that of all living creatures. We must preserve it for the good of all (Laudato Si, 2015). In Francis' view, saving the environment from damage is not only for the future of humans but also for the survival of other creatures.

So, it is clear that in its teachings, the Catholic Church mandates the Church's leadership role as a driving force in today's crucial issue of environmental conservation. Efforts to save the environment from increasingly severe damage are carried out in several ways, namely:

1. **Educate people and the wider community**Churches can routinely educate their congregation on the importance of caring for and preserving the environment. This can be done through sermons, teaching, seminars, and other environmental activities. The church can also share knowledge about the environment and the possible dangers with the community. Pope Francis (2015) stated that the Church must be humanity's voice of reason and wisdom in safeguarding this common home.
2. **Energy efficient and environmentally friendly living campaign**
3. Churches can set a concrete example by implementing energy savings around the church environment, such as turning off lights and air

conditioning when not in use, replacing electronic equipment with energy efficient ones, and reducing the use of plastic and paper.

4. **Planting trees and reforestation**
5. Tree planting activities in church areas and public places can be carried out regularly. The church can also campaign for people not to destroy forests or barren agricultural lands. These lands must be replanted with productive trees. Trees can absorb CO2 emissions and cool the earth from global warming. Greening can also be done by making vertical gardens and planting pot plants.

6. **Waste bank**
7. Churches can facilitate waste banks so congregations and the community can properly sort and recycle waste. Collected household waste can be processed into compost or useful recyclables.

8. **Action to clean rivers, beaches and the environment**
   Periodically, churches can hold clean-up actions in rivers, beaches, city parks, or other public areas. This activity not only cleans up rubbish but also increases public awareness of environmental cleanliness.

By taking an active role in the efforts above, the church can have a real impact on saving the earth. The Church needs to continue to remind its people to live in line with the will of the Creator in managing and maintaining this universe wisely (Genesis 1:28). We were all created from the earth and will return to it one day. It is appropriate for us to maintain and protect it as best as possible (Laudato Si, 2015).

**Putting Human Values in AI for the Environment**

In this modern era, artificial intelligence (AI) technology is developing rapidly and has a major impact on various areas of human life, including the environment. This impact can be in the form of goodness that can make human life easier. However, the unwise adoption of AI also causes new risks, such as bias and injustice, and can even harm humans. Therefore, it is important to prioritize moral and human values in the development and use of AI to remain in line with human and environmental needs.

Even though AI is seen as important for responding to various environmental challenges, according to Vogl (2022) in his work Governance of

Artificial Intelligence, the implementation of AI must be based on values such as Transparency, accountability, privacy, equality and democracy must be the main principles in the application of any technology to provide progress, not a disaster. In line with that, Markus et al. (2023), in the paper Ethical Artificial Intelligence for Environmental Sustainability, add that AI designers must ensure that the systems they build are aligned with the principles of justice, social welfare, and environmental sustainability. So, universal human values must be the foundation of AI for ecology.

Furthermore, a report from the World Economic Forum (2022) informs that three main human values must be instilled in using AI: inclusiveness, justice, and transparency. The value of inclusivity means that AI must be designed to benefit everyone regardless of gender, race, age and socio-economic status. The value of justice focuses on the goal of AI which must be fair, unbiased, and not harm certain groups, especially vulnerable people. Meanwhile, the value of transparency encourages the AI decision-making process to be accountable and understood by its users.

Placing these three values in AI for the environment is very important so that this technology can run in harmony with the environment. For example, AI can help accelerate the transition to renewable energy by optimizing energy plants such as solar panels by utilizing the sun. However, AI must also be designed not to waste energy, so it has a bad environmental impact. Data that uses AI to make environmental decisions should be representative and not biased towards certain groups vulnerable to the impacts of climate change. Therefore, all individuals and community groups can feel the benefits of AI well and fairly.

To achieve this, the integration of humanist values in AI needs to be done from an early stage. According to the AI Sustainability Center report (2023), AI developers must implement a human-centric design, which places humans as the main stakeholders. Apart from that, a governance framework is needed to ensure AI remains by ethical values and is not misused. Clear regulations from the government and industry standards are also needed to make AI development more responsible. Finally, education and public involvement are very important so that people understand how AI works and the impact of AI so they can actively participate in monitoring it.

By prioritizing human values as the main principle in the development and use of AI, we can maximize the advances of this technology to create a sustainable environment without sacrificing human dignity and welfare. It is the responsibility

of all governments, the technology industry, academia, and the user community so that AI can provide goodness for the environment and humanity.

Global AI governance is needed to reflect humanism principles when facing technological advances. In the opinion of Luciano Floridi (2022), The development of new technologies such as AI must prioritize humanism. How this system increases solidarity, maintains personal dignity, and contributes to the welfare of humanity. (Newsweek, June 3, 2022). This view is in line with the call of Pope Francis (2022) in a speech at the Vatican AI Ethics Conference: Algorithms and artificial intelligence technologies must not be exploited to exacerbate social inequalities and undermine inclusive equality. (Vatican News, 28 February 2022)

So, Catholic principles of justice and humanity must be integrated into AI regulations. Catholic principles such as human dignity, social justice, and respect for God's creation are relevant for responsibly developing and using AI (artificial intelligence) technology. According to the Vatican Covid Commission's 2021 report, the Catholic Church needs to participate in AI ethics discourse to ensure this technology is compatible with the values of humanism and the Catholic faith. There are several principles of Catholic teachings that can be integrated into the management and design of AI, including:

1. Respect for human dignity. AI must be developed by prioritizing human dignity as the image of God. AI must not treat humans as commodities or replace the important role of humans (Dicastery Document for Promoting Integral Human Development 2022). Humans must remain in full control and supervision of AI advances.
2. Prioritize the principles of social justice. AI must benefit all elements of society, especially improving the dignity of the poor and disadvantaged (Vatican Covid Commission Document, 2021). AI needs to be designed not to create discrimination and worsen social inequality. The data used by AI must also be representative, not biased by gender or race.
3. Respect God's Creation. The development of AI cannot destroy the environment; it must be efficient with natural resources and contribute to preserving God's created universe (Laudato Si', 2015).
4. Subsidiarity and Solidarity. The development and supervision of AI require the involvement of various stakeholders synergistically based on the principles of subsidiarity and solidarity (Fratelli Tutti, 2020). This involvement includes all elements such as government, scientists or researchers, industry and civil

society. They jointly formulate the necessary AI standards and regulations based on the principles of fairness and inclusiveness.

5. Principles of Transparency and Accountability. AI must be ethically accountable through transparency and accountability (Dicastery Document for Promoting Integral Human Development 2022). How AI works and the decision-making process needs to be explained and understood by those who use it.

Based on these Catholic principles, the development and use of AI can be directed toward serving humanity's dignity and preserving the universe. The Church and Catholics need to advocate AI ethical issues through involvement in global forums and educating people at the grassroots level. Thus, advances in AI technology can go hand in hand with integral human spiritual and moral development.

**The Negative Impact of AI on Humans and Ecology**

Even though AI can contribute to the progress of human civilization, there needs to be caution regarding its use. There is a need for vigilance not to create new problems for humans and the environment. As Francis (2023) writes in Establishing an Ethics of Care in AI Development, AI adoption without a comprehensive ethical basis and involving stakeholders risks endangering values such as privacy, gender and racial equality, and other human rights. Biomedical expert Rathenau (2022) emphasized in a paper entitled Implementing AI in Health Care: Minding the Consequences: A poorly designed AI system can potentially trigger dangerous medical errors, be biased towards certain races or genders, and even leak sensitive patient data. This means that behind the use of AI, there are also concerns about the negative impacts it might have on humans and the ecology. Some negative impacts that need primary attention include:

1. Replacement of human labor

   As AI technology becomes increasingly sophisticated, robots or machines can now replace many jobs previously performed by humans. This certainly threatens jobs and the livelihoods of many people. AI can give birth to new unemployment in society. According to a McKinsey report (2017), around 800 million jobs worldwide have the potential to be replaced by automation by 2030. So, if not handled well, this could lead to mass unemployment and deepening economic inequality. The government and industry players must prepare retraining programs and create new jobs to overcome the emergence.

2. Bias and discrimination

   Given unrepresentative training data, AI technology can produce biased and discriminatory models. For example, Amazon's AI recruiting system prefers male candidates to female candidates because the training data mostly comes from previous male Amazon employees (Reuters, 2018). Artificial intelligence must be monitored and tested regularly to ensure that gender, racial or other detrimental biases do not occur.

3. Invasion of privacy

   The collection and use of users' data by AI systems risks violating privacy. For example, tech giants such as Google, Facebook, and Amazon have been accused of excessively collecting user data to train their AI systems without explicit consent. This can threaten individual privacy and freedom. Countries need to implement regulations that protect citizens' data and privacy from misuse by AI systems.

4. Impact on climate and environment

   Large-scale AI operations require massive computing power and energy. For example, Google's data centers consume as much electricity as a medium-sized city. This contributes to carbon emissions that worsen climate change. This contributes to carbon emissions that can worsen climate change. It is necessary to increase efficiency and switch to renewable energy sources to reduce the carbon footprint of AI.

Several steps can be taken to overcome these risks, including. First, regulation and standardization of AI ethics by the government. For example, prohibiting automated decision-making systems that have the potential to be discriminatory. Second, independent auditing and certification to ensure AI systems are in line with ethical values and are not harmful. Third, encourage research to make AI more transparent and accountable (explainable AI). Fourth, empowering people to understand how AI works and the impact of AI so they can use it wisely. Fifth, apply the precautionary principle in adopting high-risk AI technology.

In Indonesia, discussions and research regarding the ethics and governance of AI need to be increased. The government needs to develop regulations and policies to control the negative impacts of AI in collaboration with industry players, academics, and civil society. This includes conducting a comprehensive study of areas that require special regulations related to AI. The main principle is to ensure AI technology brings benefits, not harm, to humans and the ecology. With

these steps, we can reap the benefits of AI to advance human welfare without sacrificing human values and environmental sustainability. Artificial intelligence should be carefully developed to serve noble purposes, not become a threat to humanity.

## Conclusion

This article discusses how Catholic teachings on the environment can be implemented through environmental transformation and AI. This article explains that the Catholic Church actively participates in environmental issues, as shown in its teachings. Pope Francis Laudato Si' encouraged humanity to care for, care for, and protect the Earth,, a common home for all. He invites everyone to change lifestyles that damage the environment.

The Catholic Church takes an integral ecological approach involving social, economic, cultural, and ethical dimensions, one way is to use advances in AI technology. AI helps in monitoring and protecting the environment. Through this accurate data, it helps governments and environmental activists to make decisions based on evidence to protect the environment. Data analysis can detect climate change and extreme weather patterns for early warning of natural disasters. AI and sensors can optimize agriculture's water, fertilizer, and pesticide use. Farmers can control soil and crop conditions quickly, reducing resource waste. AI can also help farms with environmentally friendly automation systems.

However, apart from the things mentioned above, the implementation and adoption of AI should be carried out carefully and based on ethical principles. AI can create negative consequences for the environment if this tool is misapplied. Therefore, society needs to be involved in decision-making regarding implementing this new technology. The Church should be able to play an active role by providing ethical guidance and ensuring technology is used for the good of humanity and nature. With the wise and ethical implementation of AI, harmonious environmental transformation can be achieved by the Church's teachings on the governance of God's creation.

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