**1. Agriculture:**

The production of food and other products by plating crops and rearing animals is known as agriculture. The major areas of agriculture includes crop farming, livestock, forestry and aquaculture. About 75% of the world’s poor population lives in rural areas and out of them about 86% of the people fully depends on agriculture for their livelihood (FAO. 2021). It is one of the most common land use types, covering 4.9 billion hectares (or 38 percent of the Earth's land surface) (Andrade, Pasini and Scarano, 2020). Innovation in agriculture is mostly associated with technology. Farmers have adopted more technology in their pursuit of higher yields over the centuries. Different types of farming practices has been used over the years. There is a concept of smart farming these days. Smart Farming is essential for addressing a variety of agricultural concerns, including productivity, environmental impact, food security, and sustainability (Gebbers and Adamchuk, 2010). The technologies like remote sensing, IoT, cloud computing, and big data analysis have the potential to generate new applications and services that improve agricultural productivity and food security by better understanding climatic conditions and changes (Kamilaris and Prenafeta-Boldú, 2018).

**Importance and need of agriculture with growing population:**

The agriculture industry has drastically changed over the past 50 years. It is the most important domain for every living being. It is a part of who we are, our habits and culture. Improvement in agriculture and food system improves the living standard and health of the people (Nations, 2018). As we know that population explosions are temporary. Most of the countries of the world are approaching towards the end of rapid population growth. According to UN population Division, the population is estimated to be 10.9 billion by the end of 2100 (Roser, 2019). The below figure is the estimation population projection for 2100. we can see that the global population is slowing but the population of Asia and Africa will still be increasing. To fulfill growing demand, agricultural output in Sub-Saharan Africa and South Asia would need to more than double by 2050, while in the rest of the world, the estimated rise would be only one-third higher than current levels (Food and Agriculture Organization of the United Nations, 2017).

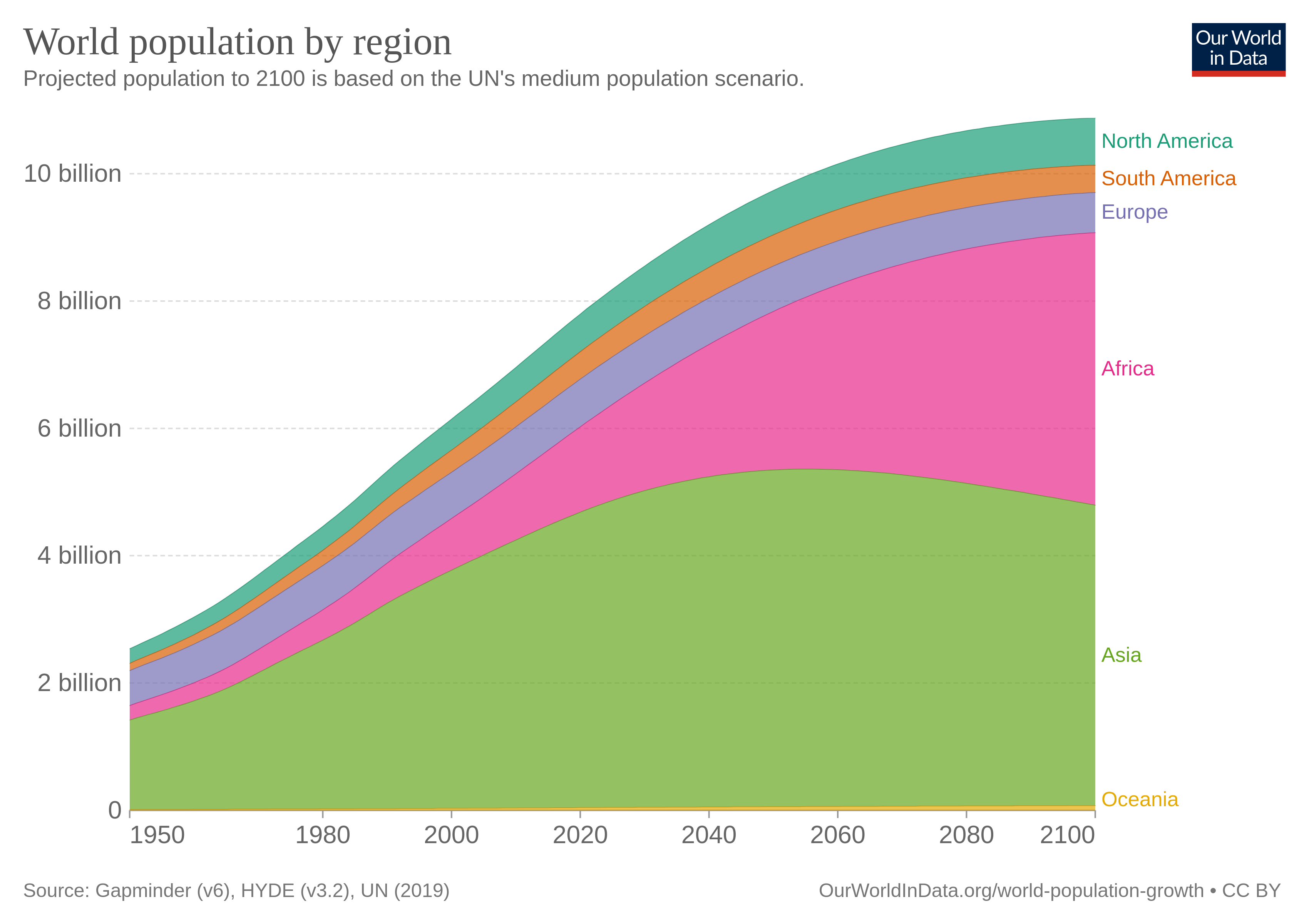


Fig: World population by region between 1700-2100 by UN population division 2019.

**Economic growth with agriculture:**

Agriculture is extremely important to the world economy. With the continued expansion of the human population, pressure on the agricultural sector will increase. It is such a domain which have the capacity to reduce poverty, improve standard of living and food security for 80% of world’s poor who are involved in farming (The World Bank, 2018). Agriculture contributes about 4% to global GDP and more than 25% to some developing countries (The World Bank, 2018). According to the FAO publication World agriculture towards 2030/2050,the global economy will increase at a pace of 2.7 percent per year. As a result, global GDP from agriculture would rise from over US$50 trillion in 2005–2007 to nearly US$126 trillion in 2050 (at constant 2005 prices) (Food and Agriculture Organization of the United Nations, 2017).

**Challenges for global agriculture:**

Around one-third of all food produced is lost or wasted somewhere throughout the food chain, from production to consumption (HLPE, 2020). The world's population is rapidly expanding, and as a result, the need for food is rapidly increasing. Farmers' traditional methods are insufficient to meet rising demand. The major challenges for global agriculture for 21st century are: food security, poverty management and sustainable natural resource management (Mccalla, 2001). The importance of time cannot be overstated. Current trends in natural resource depletion show that rainfed and irrigated agriculture production is approaching or beyond the sustainability limit. The expansion of agricultural productivity depends on increased land utilization, irrigation, and agro-chemicals. The intricate feedback loops between climate and land, expose agriculture to higher levels of risk, which must be handled (FAO, 2021). For food security and long-term production, increasing land and water productivity is critical. However, Agriculture also have damaged our environment through deforestation, nitrate pollution, emission of green house gases, land degradation, over extraction of ground water and so on. To solve these issues, a greater understanding of agricultural ecosystems that are complex, multivariate, and unpredictable is required.

**Adaptation of Technology in Agriculture**

Innovation of technologies have changed the face of agriculture throughout the time. Looking at the current trends, the future of agriculture will fully depends on technology. The farmers have adapted more technologies compared to past. The advancement of technology has bring a great revolution in agriculture and highly impacted the farmers life. With the introduction of technology in this digital era, we humans have pushed the boundaries of our thinking processes and are attempting to merge a natural brain with an artificial one. Nowadays technologies like robots, temperature and moisture sensors, GPS, and aerial images are used in the modern farms for efficient, profitable, safer and environmental friendly agriculture (USDA, 2018). Farmers don’t have to apply water, fertilizers and pesticides by themselves. Instead they can simply use a robotics technology to do all those tasks automatically. They also enable more reliable monitoring and management of natural resources. The demand of food is growing but the supply facing constraints in land and farming inputs. Nowadays agriculture can be easily done using data and connectivity. There are techniques like: artificial intelligence, analytics and other emerging technologies that could help to increase production and improve efficiency. Agriculture is less digitalized compared to other industries. However if there will be a successful implementation of connectivity then agriculture industry have the capacity to add extra $500 billion to global GDP by 2030 (Goedde, Katz and Revellat, 2020).

**Agriculture in developing countries**

In many developing countries agriculture plays a vital role.

**2. Agriculture in Nepal**

Nepal is an agricultural country. It is a major source of food, income and employment in the country. However we still rely on other countries. Climatic diversity even in a small area is a unique geographical feature of Nepal (Acharya and Kafle, 2009). The farming patterns and production of the country differs with ecological regions. The development of agriculture seems to be unsatisfactory with increase in population. Government has implemented different policies and programs to boost agriculture in the country. But due to the lack of technology, market access, transportation and irrigation there is a little hope for desire outcome (Poudel, 2020). Most of the farmers in rural areas of Nepal are smallholders who practice labor intensive farming and follow traditional method of farming. Majority of them practice subsistence farming in which work load is high and production is low. In some areas the agricultural practices has updated, management practices has changed, modern technologies and effective programs has launched, more focused on budget allocations but the pace of agricultural development has not perform as expected (Gyawali and Khanal, 2021).

**Importance of agriculture for Economic growth**

Agriculture contributes about 23.13% to the nation GDP which ranks 20th in global country rankings and 4th in Asia ranking (TheGlobalEconomy.com, 2020). About 60 percent population of the country depends on agriculture for their livelihood (The Kathmandu Post, 2021). The agriculture sector of Nepal is important to increase the income, remove poverty and to improve the living standard of the people because about 2/3 of Nepalese are involved on it. In case of Nepal, we can say that poverty is the product of unproductive agriculture. There is a very low agricultural productivity in the country but there is a great potential for rapid development and improvement through modern tools and technologies (Joshi, Conroy and Witcombe, 2019). Covid-19 has disrupted a global economy. Due to shutdown most of the farmers didn’t get the market to their production. This has highly affected the livelihood of the farmers as well as to the national economy.

**Major challenges in agriculture in Nepal**

The major challenge for the Nepal government and policy makers is to boost productivity in agriculture sector and thereby to meet the high food demand in the country. With growing population and increasing food prices the government has the major challenge to maintain balance between policies to food security and policies to improve farmers income. On the other hand, Nepal is a landlocked country. We have a diversified landscape which geographically divided in three regions: Himalayan, Hills and Terai. Frequent climatic change and too much of diversification is the major geographical challenge in the country. The population of the country is increasing day by day and land holdings are fragmented and scattered across the country. Agriculture in Nepal needs to be modernize, diversified and commercialize for sustainable development and to promote export. We have the shortage of distribution, extension channels, knowledge , production and competition. Additionally, there is also lack of storage facilities, right market, proper irrigation and communication (StartupsNepal, 2018).

The major challenges that our country is currently facing includes:

* Small productions
* Obsolete technology
* Lack of farm managerial skills
* Fragmented and small sized land
* Policy level constraints
* Lack of information services
* Right market

(StartupsNepal, 2018)

**Foreign employment trend for youth and low skilled human resources in agriculture**

Migration from developing countries to developed countries is a global phenomenon. Likewise in case of Nepal, the foreign employment rate is high. The rate of foreign migration in 2013/14 was 519,638 and in 2018/19 it decreased to 236,208 (Nepal Labor Migration Report, 2020). The Nepali immigrants sent Rs. 961.05 billion in last fiscal year 2020/21 (The Kathmandu Post, 2021), which is all time high in remittance. However the employment rate in the country has not been drastically changed. As per the report of central bank, most rural families depends on at least one member working away from home (Pant, n.d.). The skilled human resource of the country is attracted to developing countries because of better incentives, scholarship and better facilities. In case of Nepal the ratio of technician to farmer is 1:1500 whereas in other developed countries the ratio is 1:400 (The New Humanitarian, 2013). These numbers are too poor for Nepal compared to other developed countries. We are currently in the developing phase but the numbers needs to be changed with time. From Nepal about 250 agriculture graduates, 80 forestry and 70 veterinaries are produced every year, out of which about 30% go to abroad in search of better opportunities (Kattel and Sapkota, 2018). This type of skill resource migration directly affect to the sustainable development of the country. When all the high skilled human resources migrated to developed countries, the low skilled and unskilled human resources can’t uplift the condition of the country. The most of the farmers of the country are illiterate and unskilled. Due to which they can’t adapt modern practices and technologies. The traditional practices will not be changed until and unless there is a skill human resource working together with unskilled, low skilled or semi-skilled human resources.

**Current status of agriculture in Nepal**

Traditional agriculture was the dominant type in the past. There was no concept of commercial farming in Nepal. Formulation of different plans and policies in the recent years that aims to provide subsidies, improve irrigation and introducing improved seeds and modern technologies have somehow bought the concept of commercial or modern method of farming (Gyawali and Khanal, 2021). The statistics says that most of the farmers of the country are illiterate. In the recent years the youth are involving in agriculture compared to past, which is one of the benefit for Nepali agriculture. With the establishment of some agri-tech companies in the country they have built some mobile apps and other online platforms to provide information to the farmers. Because of less awareness of farmers with technologies these companies are also not able to impact most of the farmers life technically. The current scenario of farming is fully based on the middleman. From seeding to harvesting farmers needs to depend on middleman.

**3. Need of Online mobile application platform**

With the growing number of people using smartphones and tablets to access the Internet, mobile app development offers a unique opportunity to reach a wide range of potential customers (Hilliard, 2014). Nowadays most of the business is shifted to online platform by building their websites. The next phase for them will be developing a user friendly mobile application to build their customer base. In case of Nepal, farmers don’t have access to right technology, technical knowledge and institutional credit (Joshi, Conroy and Witcombe, 2019). The major factors that plays an important role for agricultural productivity would be modern technologies and inputs. So with the help of modern technologies they can easily communicate with the experts and learn more about agriculture. They can also sell their products online.

**4. Mobile application development**

Mobile applications are becoming more popular day by day. Nowadays we have apps for almost everything. From a simple Todo application to large artificial intelligence applications the mobile app world is becoming more vast and friendly. In the early stage people use mobile phone for calls, messaging, clocks, calculator etc. Then there comes the internet based mobile apps. This has revolutionize the mobile app field. With the internet penetration, the mobile application domain has been updated with time. There are mainly three types of mobile applications: Native, web and hybrid applications.

**Native Apps**

These types of apps are created for one specific platform or operating system. Those types of apps are built either for android or IOS but not for both at the same time. We can run native android apps on android platforms and native IOS apps on IOS platform. There is also the benefits of native apps. Because of their single platform focus they are faster and reliable compared to hybrid apps. However writing a native apps means rewriting every code for different platforms. When the user gets an update they have to download the new file and reinstall it. These types of apps are developed by using various programming languages like: Java, Swift, C, C++, React etc.

**Web Apps**

These are the fully responsive websites that can work on any mobile devices or operating system. They response like native apps but they can be access from browsers as well in the mobile devices. They are not the complete mobile application but a response website that adapt interface according to the device. We don’t have to manually install these types of application. We can access them simply by typing an URL in web browser. For these types of apps we don’t need to customize platforms or operating systems. Moreover, user don’t need to download anything to run these types of apps which don’t take any space in the device. However, these types of apps fully depends on browsers. That can sometime cause of problem like if one browser support all the features and functionalities then other may not be capable of supporting them. These types of apps are coded using HTML5, CSS, JavaScript, Ruby and so on.

**Hybrid apps**

These are the combination of native and web apps. They do have app icon, responsive design, better performance and some of them can able to function offline. We can also say that these are the web apps that are made to look native. Building these types of apps are more quicker and economical compared to native apps. These types of apps can be downloaded form play store or apple store. They are write once and run anywhere type of application. Having platform independent they have the single code base, which means there is much less code to maintain. However they have some cons as well. They might lack in power and speed. Technologies used for developing these types of apps includes Ionic, Objective C, Swift, HTML5 and so on.

**Technologies used in this project**

**Dart**

Dart is an open-source, general purpose, object-oriented programming language developed by Google in 2011 (Java T Point, 2021). it is a client optimized language for developing fast applications for all platforms. We don't need any compiler to compile dart programming language. This program is used to create interfaces for web and mobile apps. It support most of common concepts of programming languages like classes, functions, interfaces.

**Flutter**

Flutter is a open source framework developed by google for mobile user interface. It uses dart as a programming language. Flutter support cross platform which can be write once and run in different platforms. It helps us to develop easy and productive mobile apps for android and IOS. The another part of this is it will remove the development cost.

**Firebase**

Firebase is a Backend-as-a-Sevice that provides variety of tools to develop quality apps to the developers. It is also developed by google. It has a services like analytics, databases, storage, push messaging, authentication and so on (Stevenson, 2018). All of the Firebase services are hosted in the cloud and developer can easily configure them with a single clicks.

**Visual Paradigm**

Visual paradigm is the application that is used to model business information system and manage development processes by software development teams (TRM Mgmt Group, 2021). It provides report and code generation as well. It is used for designing user case diagrams, activity diagrams, class diagrams, database schema and so forth.

**Balsomiq Prototyping**

Balsomiq is a low-fidelity prototyping tool that is used to wireframe software interfaces for mobile, desktop and so on. It includes simple drag and drop features which makes quite easier for everyone to use.

References:

*(FAO*. 2021). *Decent Rural Employment | Food and Agriculture Organization of the United Nations*. [online] Available at: https://www.fao.org/rural-employment/en/ [Accessed 30 Nov. 2021].

Nations, U. (2018). *Feeding the World Sustainably | United Nations*. [online] www.un.org. Available at: <https://www.un.org/en/chronicle/article/feeding-world-sustainably>.

Andrade, D., Pasini, F. and Scarano, F.R. (2020). Syntropy and innovation in agriculture. Current Opinion in Environmental Sustainability, [online] 45, pp.20–24. Available at: <https://www.sciencedirect.com/science/article/abs/pii/S1877343520300579>.

Gebbers, R. and Adamchuk, V.I. (2010). Precision Agriculture and Food Security. Science, 327(5967), pp.828–831.

Roser, M. (2019). *Future Population Growth*. [online] Our World in Data. Available at: <https://ourworldindata.org/future-population-growth>.

The World Bank (2018). *Overview*. [online] World Bank. Available at: <https://www.worldbank.org/en/topic/agriculture/overview>.

The World Bank (2018). *Overview*. [online] World Bank. Available at: [https://www.worldbank.org/en/topic/agriculture/overview](https://www.worldbank.org/en/topic/agriculture/overview" \l "1)#1.

TheGlobalEconomy.com. (2020). *GDP share of agriculture by country, around the world*. [online] Available at: <https://www.theglobaleconomy.com/rankings/share_of_agriculture/>.

Nepal Labor Migration Report (2020). [online] Available at: <https://moless.gov.np/wp-content/uploads/2020/03/Migration-Report-2020-English.pdf>.

The Kathmandu Post (2021). Remittance hits Rs961 billion, an all-time high in the time of Covid-19. [online] Available at: https://kathmandupost.com/money/2021/08/22/remittance-hits-rs961-billion-an-all-time-high-in-the-time-of-covid-19 [Accessed 7 Dec. 2021].

Pant, B. (n.d.). Harnessing Remittances for Productive Use in Nepal. [online] Available at: https://www.nrb.org.np/contents/uploads/2019/12/Economic\_Review\_Occasional\_Paper-No\_23\_April\_20111\_Harnessing\_Remittances\_for\_Productive\_Use\_in\_NepalBhubanesh-Pant-Ph.D..pdf [Accessed 7 Dec. 2021].

Poudel, B.R. (2020). Absent Nepali agriculture jobs. [online] The Annapurna Express. Available at: https://theannapurnaexpress.com/news/absent-nepali-agriculture-jobs-2526 [Accessed 7 Dec. 2021].

‌The Kathmandu Post (2021). Nepal wants to be an agriculture-driven economy but future of the sector is in crisis. [online] Available at: https://kathmandupost.com/money/2021/06/29/nepal-wants-to-be-an-agriculture-driven-economy-but-future-of-the-sector-is-in-crisis [Accessed 7 Dec. 2021].

The New Humanitarian. (2013). The trouble with Nepal’s agriculture. [online] Available at: https://www.thenewhumanitarian.org/report/97321/analysis-trouble-nepal%E2%80%99s-agriculture [Accessed 7 Dec. 2021].

Kattel, R.R. and Sapkota, M. (2018). Brain drain of agriculture and veterinary graduates to abroad: evidence from Nepal. Agriculture & Food Security, 7(1).

Joshi, K.D., Conroy, C. and Witcombe, J.R. (2019). Agriculture, seed, and innovation in Nepal: industry and policy issues for the future. Gates Open Res, [online] 3(232), p.232. Available at: https://gatesopenresearch.org/documents/3-232 [Accessed 9 Dec. 2021].

Gyawali, P. and Khanal, S. (2021). Overview of Agriculture in Nepal: Issues and strategies to cope with. Fundamental and Applied Agriculture, (0), p.1.

StartupsNepal (2018). Agribusiness and the Problems Facing Agriculture in Nepal. [online] Starups Nepal. Available at: http://www.startupsnepal.com/stories/entry/agribusiness-and-the-problems-facing-agriculture-in-nepal [Accessed 9 Dec. 2021].

Acharya, A.K. and Kafle, N. (2009). Land Degradation Issues in Nepal and Its Management Through Agroforestry. Journal of Agriculture and Environment, 10, pp.133–143.

Gyawali, P. and Khanal, S. (2021). Overview of Agriculture in Nepal: Issues and strategies to cope with. Fundamental and Applied Agriculture, (0), p.1.

USDA (2018). Agriculture Technology | National Institute of Food and Agriculture. [online] Usda.gov. Available at: <https://nifa.usda.gov/topic/agriculture-technology>.

Goedde, L., Katz, J. and Revellat, J. (2020). Agriculture’s connected future: How technology can yield new growth. [online] McKinsey and Company. Available at: https://www.mckinsey.com/industries/agriculture/our-insights/agricultures-connected-future-how-technology-can-yield-new-growth [Accessed 9 Dec. 2021].

FAO (2021). The State of the World’s Land and Water Resources for Food and Agriculture – Systems at breaking point (SOLAW 2021). [online] Available at: https://www.fao.org/documents/card/en/c/cb7654en [Accessed 10 Dec. 2021].

Food and Agriculture Organization of the United Nations (2017). The future of food and agriculture – Trends and challenges. [online] Available at: https://www.fao.org/3/i6583e/i6583e.pdf [Accessed 10 Dec. 2021].

HLPE (2020). FOOD SECURITY AND NUTRITION BUILDING A GLOBAL NARRATIVE TOWARDS 2030. [online] Available at: https://www.fao.org/3/ca9731en/ca9731en.pdf [Accessed 10 Dec. 2021].

Mccalla, A. (2001). Challenges to World Agriculture in the 21st Century. [online] 4(3). Available at: https://s.giannini.ucop.edu/uploads/giannini\_public/48/01/4801e886-3406-4e10-b499-ed6147f457e8/spring2001\_1.pdf [Accessed 10 Dec. 2021].

Kamilaris, A. and Prenafeta-Boldú, F.X. (2018). A review of the use of convolutional neural networks in agriculture. The Journal of Agricultural Science, [online] 156(3), pp.312–322. Available at: https://pdfs.semanticscholar.org/284a/9cb0b78c17e60597fe92a3d3cca0d7487c13.pdf [Accessed 10 Nov. 2019].

Java T Point (2021). What is Dart Programming. [online] Java T Point. Available at: https://www.javatpoint.com/flutter-dart-programming [Accessed 12 Dec. 2021].

Stevenson, D. (2018). What is Firebase? The complete story, abridged. [online] Medium. Available at: <https://medium.com/firebase-developers/what-is-firebase-the-complete-story-abridged-bcc730c5f2c0>.

TRM Mgmt Group (2021). Visual Paradigm. [online] U.S. Department of Veteran Affairs. Available at: https://www.oit.va.gov/Services/TRM/ToolPage.aspx?tid=10208# [Accessed 17 Dec. 2021].

Hilliard, A. (2014). Why Mobile Applications Are Important; Especially Its Development. [online] Acclerance. Available at: https://www.accelerance.com/blog/why-is-mobile-app-development-so-important-today [Accessed 18 Dec. 2021].