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lightcode

Strengthening the Digital Transformation of Higher Education Through Low-Code

3. Application Development for All

Symplexis

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3. APPLICATION DEVELOPMENT FOR ALL (SYMPLEXIS)

This chapter discusses how low-code levels the playing field, allowing people from various backgrounds and skill levels to engage in application development. The chapter aims to support the Erasmus+ objective of inclusive digital transformation by exploring how low-code technology promotes equal opportunities in application development. It enables individuals from diverse backgrounds and skill levels to actively engage with digital tools. The emphasis is on the accessibility and democratization of technology, aligning with the project's goal to empower learners through inclusive and practical digital solutions. This module also complements later chapters introducing tools like LightCode.

3.1 Preliminary Overview and Foundations

3.1.1 Overview

The world in which we live is diverse. But the world is changing and becoming increasingly dependent on technology, creating new opportunities and challenges. One of them is that, because of the rapid technological development, some people are being left behind, as they do not have time to acquire the new (digital) skills needed. Due to social factors, these people do not have equal access to education and digital skills, and this can also lead to exclusion from the labour market and thus to economic and social inequalities, creating a vicious circle of exclusion (OECD, 2022; UNESCO, 2020a,b). Yet the issue can be mitigated by learning and spreading the use of low-code. Low-code, thanks to its features, makes programming accessible to a wider audience, as users can now develop digital applications without having a high level of expertise (Forbes Technology Council, 2020). Consequently, people who would otherwise not have access to advanced digital skills can now actively participate in software development, become competitive in the labour market and design applications according to the needs of all people.

3.1.2 Why & Learning Outcomes

Although digital skills are almost a prerequisite for finding a job, there is still a significant proportion of the population that does not master them (European Commission, 2017; Eurostat, 2022b). And the largest share of those who do not have (advanced) digital skills belongs to vulnerable groups, such as people with low income and/or migrant background, older adults, disabled people, and women (Zilian & Zilian, 2020). In this module we will, therefore, explore how low-code can democratise coding and facilitate the development of accessible digital content, thus helping to address the aforementioned challenges and enabling society to benefit from its diversity.

Learning Outcomes:

- Understand the benefits of diversity and inclusion.
- Recognize the role of low-code in democratizing technology access.
- Acknowledge how low-code enhances employability entrepreneurship.
- Recognize how low-code opens up digital opportunities for diverse backgrounds.
- Understand how low code fosters the development of accessible web content.

3.1.3 Prerequisites

- Basic knowledge on low code.
- Basic concepts of application development.

3.2 Detailed Exploration

3.2.1 Introduction to diversity, inclusion & equity

Just by looking around, it will not be difficult to notice that people are different from each other. These differences may be related to race, ethnicity, origin, gender, sexual orientation, physical and mental ability, religion or socio-

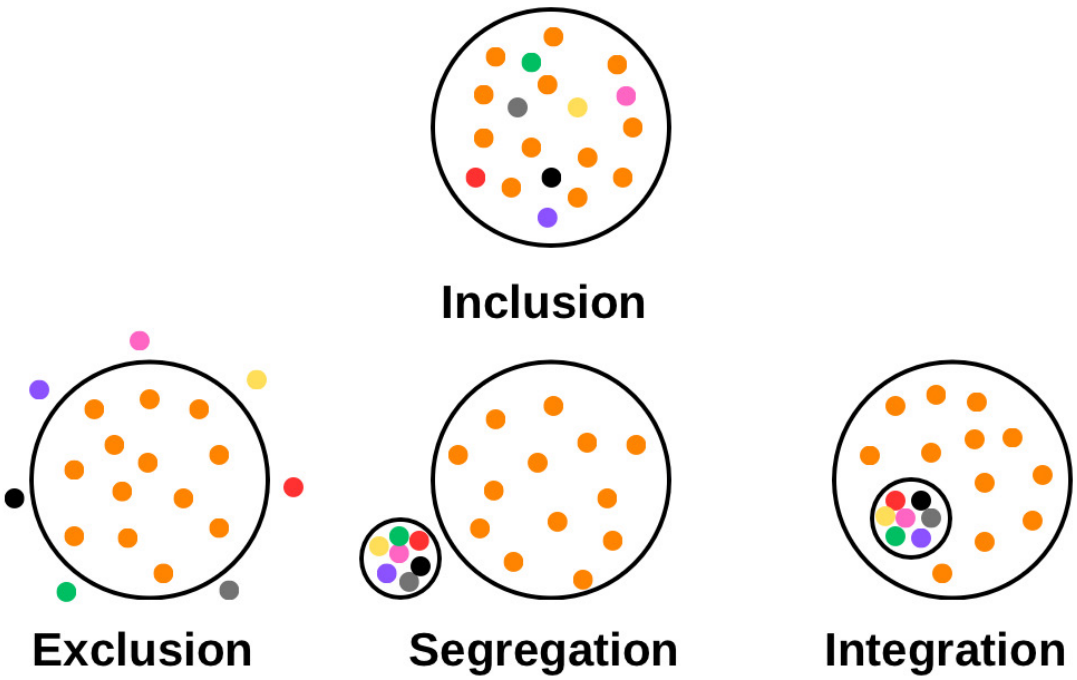
economic background and represent the diversity that is a defining characteristic of the human race (UNESCO, 2017). However, despite the existence of diversity, societies are often structured according to certain norms and standards, and any individuals who 'fail' to follow these norms (e.g. women, migrants, disabled people, etc.) experience exclusion. This exclusion stems from structural and social barriers that block or deny full access to rights, opportunities and resources (e.g. education, employment, etc.) to individuals who deviate from the prevailing norm (ECPS, n.d.). Examining statistics on the participation of women, migrants and disabled people in higher education and employment confirms this phenomenon:

- The share of non-EU citizens aged 18-24 that are early leavers from education and training is around 26%, while the corresponding share for EU citizens is around 8% (EUROSTAT, 2023b).
- Only 15% of disabled people entered higher education (ESU, 2018).
- Although the overall enrolment of women in higher education does not differ from that of men, there is segregation by field of study. For example, only 1/3 of STEMS studies graduates are women (Copernicus, 2022).
- The unemployment rate of migrants in Europe is on average about 8% higher than that of EU workers (Caritas Europa, 2022).
- Only 50% of disabled individuals are employed, while the corresponding rate for non-disabled people is 75% (Caritas Europa, 2022).
- The employment rate of women in the EU is ten percentage points lower than that of men and the gender pay gap is more than 35% (Eurostat, 2023a).

Given the above, it is clear that there is a need for more just societies, as also reflected in the UN Sustainable Development Goals number 4: "Ensure inclusive and equitable quality education and promote lifelong learning opportunities for all"; number 8: "Promote sustained, inclusive and sustainable economic

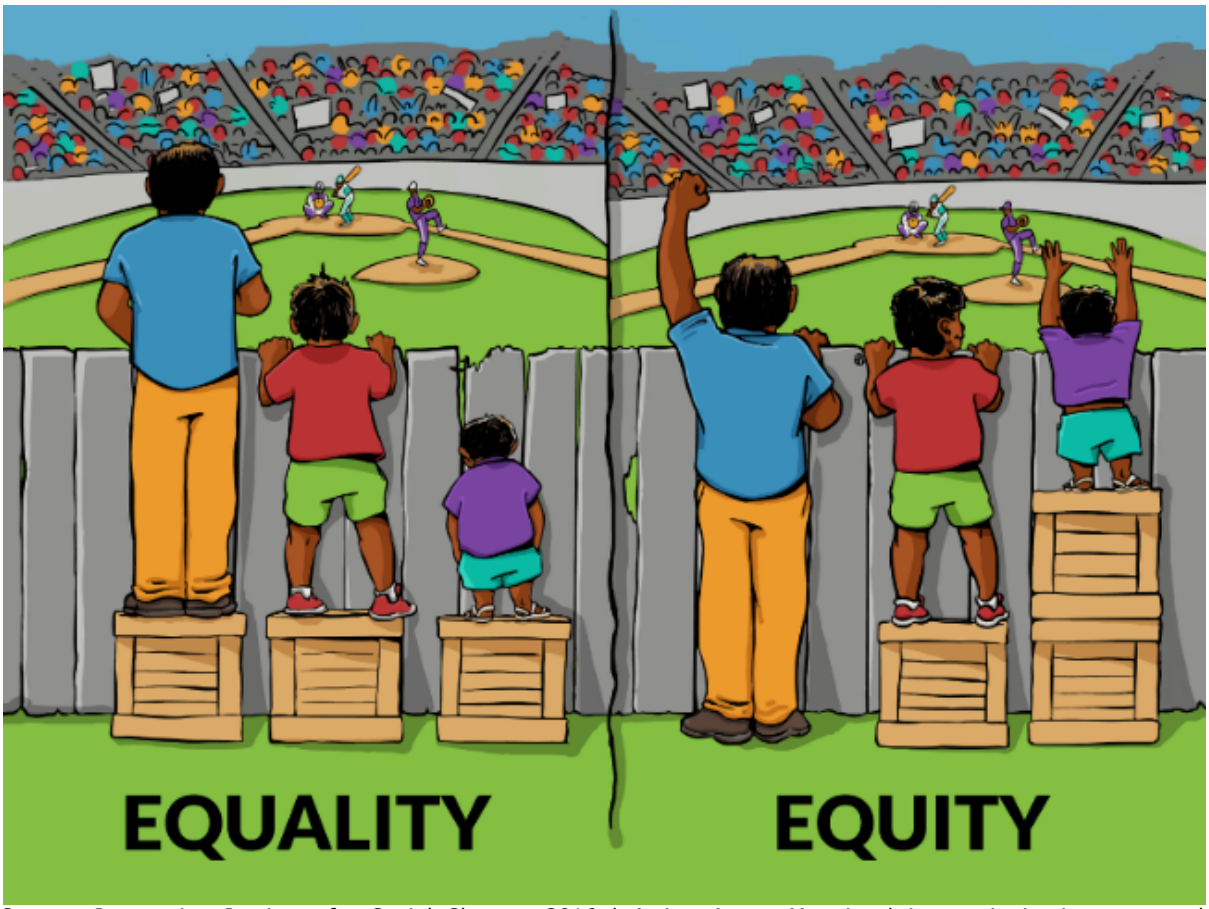
growth, full and productive employment and decent work for all"; and number 10: "Reduce inequalities within and among countries" (UN, n.d)

The process of creating environments/societies in which all individuals are supported, represented, and feel welcome is called inclusion (UNESCO, 2017). Put simply, the environment adapts to the needs of the individual regardless of the individual's characteristics and background, thus making them an equal and productive member of society. There is often a misconception that the term refers only to disabled people but in fact it refers to any individual who, as mentioned above, deviates from the norm and faces structural and social barriers. The term 'inclusion' should also not be confused with the term



'integration', as although 'integration' recognises diversity and takes steps to enable the individual to participate in society, the individual must adapt to social requirements in order to be as functional and productive as other members of society (UNESCO, 2020b).

Another key concept is that of equity. Equity means providing support by removing barriers, implementing policies, and distributing resources to ensure fair treatment of all individuals, but taking into account their different backgrounds and needs (UNESCO, 2017). Note that equity differs from equality, in which 'equality' provides equal support but does not take into account the different needs that members of society may have (UNESCO, 2020b)



Source: Interaction Institute for Social Change, 2016 | Artist: Angus Maguire | interactioninstitute.org and madewithangus.com

Before examining the importance of digital skills and coding and how their acquisition can enhance inclusion, we must first consider the benefits of diversity and inclusion. These benefits can be both social and economic but can also be related to the development of soft skills of the individual. So, let's

look into some of them below (Deloitte, 2019; Mezzanotte, 2022; UNESCO, 2020a,b).

- Individuals are prepared for a diverse world/society: The world is diverse, and we need to learn to interact with people who have different appearances, culture, and perspectives. And a diverse classroom/ workplace/ circle of friends contributes to this.
- Development of the individuals' emotional intelligence: The interaction between people from different backgrounds and with diverse experiences allows them to better understand that various perspectives exist, and that people face barriers in their daily lives. Also, because of the different perspectives, conflicts may arise that need to be resolved. The above assist students to develop their emotional intelligence by cultivating skills such as empathy, active listening, etc.
- Combating stereotypes and stigma: Daily contact with people from different social groups breaks down many of the stereotypes that may be associated with them as it eliminates alienation and social gaps.
- Creativity and innovation: The interaction among people with different experiences, opinions, and perspectives enhances creativity and innovation (Stahl, 2021). Also, when you feel welcomed & included you are less likely to be afraid to fail, challenge the status quo, take risks, and express and share new ideas. Research has shown that companies with above-average diversity scores have higher innovation revenues (Bersin, 2015).
- Faster & better group decision making/problem solving: Teams consisting of people from different backgrounds are more effective in decision making and problem solving as there is a variety of perspectives and alternatives that can lead to better solutions/decisions (Reynolds & Lewis, 2017).

- Increasing human capital: When people are excluded from education and/or the labour market, this constitutes a loss of human capital. Inclusion, therefore, also leads to a larger pool of talent.
- Increased business profitability: Businesses with a higher level of diversity are more likely to be more profitable than those with lack of diversity (Hunt, Layton & Prince, 2015).
- Lower unemployment & income inequalities: Inclusive education and labour market ensure that more people will have the skills and opportunities to access employment and therefore (higher) income.
- Improved health: Inclusion reduces social isolation and increases social participation, which is beneficial for (mental) health as it reduces the levels of anxiety and depression.
- Reduced social services costs: Reduced unemployment means that less unemployment and support benefits will be needed, while better health will result in less pressure on the public health system.

Example: Could diversity have prevented the financial crisis of 2008?

Sallie Krawcheck is the CEO of Elevest, a company that provides financial advice primarily to women. She has also been the head of Bank of America's Global Wealth and Investment Management division and Chief Financial Officer for Citigroup Inc and has been known as the most powerful woman of Wall Street. Krawcheck was fired from Citigroup in 2008 after a disagreement with the CEO, as she argued that Citi should compensate clients for deficient investments spread by Citi's brokers and bankers (Picchi, 2017).

In an interview with the CBS network nearly a decade later, she claimed that her dismissal was not due to her gender, but because her opinion differed from the prevailing majority. As she argues, one of the key problems of Wall Street was that the lack of diversity created a "false comfort of agreement". She therefore believes that if there had been more diversity in terms of education,

colour, gender and therefore in thoughts and perspectives, it is highly possible that the crisis would have been much less severe (Picchi, 2017).

This view can also be supported by studies, such as those of the Peterson Institute for International Economics and Credit Suisse, which show that companies that have women on the management board and in senior positions are more profitable than those whose positions are filled only by men (Picchi, 2017).

True/False Quiz

True or false? Read the following statements and indicate whether they are correct or incorrect:

- For a company to be inclusive, it is enough for it to be accessible to disabled people.
- The concepts of "equity" & "equality" are not identical.
- Inclusion is a moral obligation but has no significant benefits.
- Women do not face barriers to education as their enrolment rate is the same as that of men.
- A business that has a diverse workforce is more likely to be profitable than one that does not.

3.2.2 Redefining Digital Skills' Accessibility

Imagine a typical day in your everyday life. Have you ever wondered how often you used technology and the internet during a day like that? Either alone at home, at work, or with your friends for fun. Probably very often! Because now technology is everywhere! So, you would expect that most people would now be comfortable using technology as they would have at least the basic digital skills.

But the reality slightly differs from this perception. According to Eurostat, only around 50% of EU citizens aged 16-74 have basic digital skills. The leading countries in this statistical category are the Netherlands and Finland where almost 80% have basic digital skills, while Bulgaria and Romania are at the bottom with around 30% (Eurostat, 2022b). However, these rates are likely to be significantly lower when referring to advanced digital skills. According to a survey conducted by the Learning and Work Institute in partnership with Enginuity and WorldSkills UK, only 18% of young people consider themselves proficient in more complex digital skills, such as coding (World Skills Skills UK, 2021).

But how could this change? One approach would be to make advanced skills more "accessible". Could low-code contribute to this?

Low code development is a software development method that allows users to design applications through a visual interface with little to no use of high code, which allows people without a high level of IT expertise to use it. This practically means that anyone can build mobile or web applications by connecting, through pre-defined components and by writing little to no lines of code (Yan, 2021).

As a result, learning and using low-code becomes much easier without requiring specialized studies in a related field, such as IT or engineering (Yan, 2021). The ease of teaching low-code also makes it cheaper to learn. There are even free low code learning platforms available. Therefore, advanced digital skills such as coding and application development may no longer be a privilege of a few STEM & ICT graduates and become accessible to a growing number of people.

Yet, low-code features do not only benefit individuals but also organisations and businesses. As a consequence of these features, mobile & web application development is becoming much faster (about 5-10 times faster) and also

cheaper as fewer working hours and non-technical staff are now required (Yan, 2021). Also, low code apps, since they don't have as many lines of code, need less effort for their maintenance. Last but not least, the fact that applications can now be developed by non-technical staff and more specifically by the people directly involved in the operation of the organization, enables the organization to create these applications according to the exact needs and even with more privacy as outsourcing will not be necessary (Yan, 2021).

Thus, low code becomes accessible and attractive to a far greater number and variety of organizations and businesses. In fact, according to research by Gartner, by 2024 65% of application development projects will be done using low-code (Shah, 2023).

Example: Women in Tech against COVID

During the first few months of the pandemic, we were all locked up in our homes and apparently the offices of the companies were also closed. But when the time came for them to reopen and we started to get back to normality, the issue that arose was that not all employees could be in the workplace at the same time because of social distancing guidelines. This added a significant extra workload for companies as they had to organise a schedule every day/week so that no more workers than allowed were in the office at any given time.

A solution to this problem came from Marieke Dijksma, Chief Technology Officer of Dutch company Octo, which is a provider of smart-building services. Dijksma, using low-level code, developed within a week an application called HeadsUpp, which allows users to declare the days they plan to come to the office while simultaneously sending a notification to their colleagues, thus helping to determine whether there is enough space for the employees coming to the office (Mendix, n.d).

As a result, this app has helped companies reopen their offices while keeping employees safe and healthy, and it is estimated that its use can save office managers 4 hours of extra work per week (Mendix, n.d)!

Self-reflection Exercise:

Time for some self-reflection! Write down on a sheet of paper the digital skills that you think you have and consider to be useful in the labour market (e.g. editing text/spreadsheets/presentations, photo/video editing, coding, understanding how a computer works, etc.). Would you rate them as low, basic or advanced? What factors do you consider having contributed to the (non-)acquisition of these skills?

3.2.3 The Rise of Citizen Developers

As we saw in the previous section, low-code has "liberated" coding, making it more accessible to individuals and organisations. This combination has created a new breed of developers. The "citizen developers"!

A citizen developer is a non-professional/non-IT employee of an organisation who uses tools approved by IT and/or business units for application development and delivery (Yan, 2021). The citizen developer could be a marketer, project manager, designer etc (they must be a legal employee of the organisation) and they report to a business function or unit other than the IT (Gartner, n.d). Similarly, citizen development is the process in which an organization encourages non-IT employees to become software developers themselves to develop applications for the organization utilizing low-code or no-code platforms (Kirvan, Liptak & Horwitz, n.d).

The adoption of this practice has significant benefits for the organisation, some of which have also been mentioned in a previous section (Carrol, Morain, Garrett & Jamnadass, 2021; Kirvan, Liptak & Horwitz, n.d; Madding, 2023):

- Faster application development: The involvement of citizen developers combined with the advantages of low-code features (fast and easy to use) can speed up the software development process.
- "Freeing up" the IT department: citizen developers can work on the simpler tasks, allowing the IT department to focus more on the more complex tasks of the organisation.
- Reduced costs: Involving citizen developers in the application development reduces the need for outsourcing. The speed at which an application can be developed also has the same effect on costs.
- Enhanced privacy: Application development can more easily be done in-house without involving an external partner.
- Greater responsiveness to the needs of the organisation: The application can be developed and customized by the citizen developers exactly based on the needs of the business department/organization and not outsourced to the IT department or external partners who do not have an accurate picture of the issue/needs.
- Innovation: The involvement of citizen developers, i.e. employees directly involved in the operations of the organisation, can bring new ideas to application development.

Example: Citizen Development is more than just a low-cost solution

As mentioned above, low-code and citizen development can be an important tool for organizations that do not have the resources to develop applications working with IT professionals. However, citizen development is also used by mega enterprises with huge turnover as designing applications by employees who are directly involved in the day-to-day operations of the company and have a better understanding of the needs of the department/company can have significant benefits for the organization.

A notable example is Shell, which has created the Shell DIY Program to enable its staff to create customized solutions for their daily process. Thanks to this

program, a significant number of applications have been created with significant benefits with two of them being the following (Carroll & Maher, 2023):

- Pump management tool and pump card: engineers at the Shell Deer Park refinery developed an application to help them manage and oversee complex maintenance procedures for the refinery's pumps. As, until then, there was no effective way to visualize the overall condition of the pumps and the safety risks of maintenance, the application provided access to the required data, ultimately increasing the efficiency of pump maintenance, and reducing the risk of unplanned outages, emergency repairs and associated costs.
- Lifting and hoisting applications: during the construction of a Shell petrochemical complex, dozens of lifts and hoists of equipment and materials were required daily. However, before each lifting operation, a (manual) approval process was required, which demanded many on-site moves and took a total of almost 2.5 hours. So, for this reason an application was created which automated the approval process making the process faster but also enhancing safety. Thanks to the application the process time was reduced by 1.5 hours thus significantly reducing costs and leading to almost 2 million dollars of efficiency gain per year.

Multiple Choice Quiz

Choose the correct answer:

1. A citizen developer...
    - Must have a degree in computer science.
    - Does not have the skills required to design and develop an application.
    - Could be a marketer working in the organization.

2. Which of the following is not one of the advantages of citizen development?
    - There is no need for IT professionals at all as citizen developers have more coding skills.
    - The applications developed better meet the needs of the department/organization.
    - It can reduce costs.

3.2.4 Low-Code, Employability and Entrepreneurship

We now live in a world where the use of technology and computers is an essential part of our daily lives. This of course could not leave the labour market unaffected. For example, according to European Commission data, 98% of workplaces require managers to have basic digital skills, while the corresponding percentage for professionals, technicians, clerical workers or skilled agricultural workers is also very high, namely 90% (European Commission, 2017). At the same time, a significant percentage of workplaces (i.e 30% & 50%, respectively) require managers and professionals as well as technicians to have advanced digital skills (European Commission, 2017). Furthermore, the demand for coding skills has grown 50% faster than the demand for overall jobs in the past decade (Gitnux, 2023), while in the US about half of the jobs with annual wage more than 57,000$ require coding skills (Hill, 2017).

The aforementioned figures are also the result of the fact that technology is now an integral part of business operations. In the EU, for example, 75% and 89% of small and medium-sized enterprises, respectively, have a website (Eurostat, 2022a). Furthermore, about 30% of small businesses use ERP (Enterprise Resource Planning) and/or CRM (Customer Relationship Management) with the corresponding percentage in medium-sized businesses ranging from 50% to 60% (Eurostat, 2022a). Also, the percentage of small and

medium-sized businesses that have a mobile app stands at 14%, while 34% plan to develop one (Statista, 2023).

In this era of technological development, low code programming has also emerged rapidly. For example, in 2020, around 25% of applications developed by organisations used low/no code technologies, with this figure expected to triple by 2025 (Gartner, 2021). Moreover, the use of low-level code is not limited to the field of IT/software development. Some of the areas in which the use of low-code applications is being expanded are banking and finance, manufacturing, construction, real estate, education, health care, but it is also used by governments and NGOs, for functions such as workflow management and automation, customer relationship management, administrative functions, property management, donor management etc. (Lieberson, 2021).

However, this rapid growth has created two main problems. The first is that a skill gap is being created, as the available workforce does not "catch up" with the skills required by the labour market. In fact, according to a McKinsey survey, "IT, mobile and/or web design and management" is one of the business areas where skill gaps are most likely to occur (McKinsey, 2020). The second is that, as business e-tools have significant benefits in both customer acquisition and sales, as well as in the smooth running of the organisation, there is a risk that organisations that don't use them will fall behind and fail. And this risk is greater for small businesses, which make up the majority, as they do not have the financial and human resources to respond to the digitalisation of their operations (UNCTAD, 2021)

Against these new challenges, low-code can be both a solution as well as an opportunity. Low code, unlike traditional coding, has features that make it accessible to people without the relevant studies. This can increase the talent pool and enable the workforce to meet the needs of the labour market. Low-code can even be an opportunity for those willing to learn it, as they will have a competitive advantage and be more in demand than people with zero coding

skills. In addition, small businesses that cannot afford to hire or engage IT professionals to develop and operate e-business tools can now survive and be competitive with other businesses, as the needed software applications can be developed by non-IT professionals already working in the organization.

Example: Low-code against major crises

In the 2020s Europe faced 2 major crises, the COVID-19 pandemic and the war in Ukraine. These crises raised unprecedented challenges, which had to be addressed immediately as human lives were at stake and there was no time to lose.

When the war in Ukraine started, millions of people fled their homes, many of them heading for Poland, creating a huge need for humanitarian aid (food, medicine, etc.). However, as the amount of humanitarian aid and the number of volunteers increased, the issue of how best to distribute it, according to the needs of each refugee centre, arose. To solve this problem, synergies were established between humanitarian organisations and software development companies and the result was the development, in a few weeks or even days, of low-code applications for registering and organising volunteers, and recording and allocating donations, which seemed almost impossible as it would be necessary to automate processes in such an unstable environment such as a war zone (Caspio, 2023; Peters, 2022).

During the pandemic, hospitals were under tremendous pressure as the number of patients increased. In the Netherlands, therefore, to optimise the allocation of patients to its hospitals, the National Coordination Center for Patient Distribution (LCPS) was established. To achieve this, LCPS developed a coordination application/platform using low-level code, which checks the availability of beds and, depending on transport capabilities and other variables, matches patients with hospitals (ICT&health, 2020).

Both of the above cases highlight the speed and flexibility with which we can respond to calls using low-code applications. So, in a matter of days, and with the input of the people directly involved in each issue, e-tools can be created that offer solutions to either large-scale problems, such as a pandemic, or smaller ones, such as those that arise during the operation of a business.

Reflection Exercise:

Below are some examples of companies/organisations from different sectors:

- A large construction company which is active in the housing sector.
- A municipal waste management service of a municipality in a large city
- A university.
- A small retail clothing store.
- An NGO providing free language courses to migrants.

Think about what problems/challenges the above organisations might face in terms of day-to-day operations, customer service, logistics, etc. Pick one of them and consider how you could offer a solution for it with the help of a low-code application.

3.2.5 Empowering Diverse User Groups

It has been shown that digital literacy can also be correlated with a person's background. More specifically, men, higher income individuals, and individuals living in urban areas are more likely to master basic and advanced digital skills in comparison to women, low-income individuals, and individuals living in rural areas, respectively (Zilian & Zilian, 2020). This may be due to social stereotypes (e.g. "women are not into science") leading to gender segregation by field of study and the barriers faced by some social groups (migrants, disabled people, etc.) who do not have equal access to (quality) education, as we saw in the first section. Furthermore, younger people are found to have more developed digital skills than older people, which is probably due to the

higher degree of familiarity with technology among the younger generation (Zilian & Zilian, 2020).

However, this disparity in digital skills may lead to income inequalities, as digital skills tend to become a prerequisite for finding a job, and thus also exacerbate social inequalities.

Potentially, this could be mitigated by the use of low-code. First of all, the fact that it is easier, does not require high skills and can be cheaper to learn compared to traditional coding allows people from different backgrounds who may have lower incomes and/or may not have equal access to higher education to acquire this digital skill, enrich their CVs and seek employment, having a greater chance of finding a job and having a higher income, thus mitigating the exclusion they experience. Also, the low level of ICT qualification required opens up the possibility to include low code courses in fields of study that traditionally do not include courses related to digital skills, such as humanities. Thus, coding skills will not be a privilege only for graduates of STEM and ICT schools where a very low enrolment of women can be witnessed. This could reduce the negative effects (i.e. gender pay gap) of gender segregation by field of study as more women will have the required coding skills for higher paid jobs.

The use of low-code combined with the increased workload in IT departments since the COVID pandemic which forced them to involve non-technical staff can enhance diversity even in the ICT/technology industry. In a survey conducted by Mendix among 2000 IT professionals, about 40-50% of the respondents believed that low code could empower more people, especially older adults, and people of different races, to overcome social barriers and work in the IT field (Mendix, 2021). However, we still have a long way to go as 74% of girls do not consider a career in computer science due to lack of exposure to coding during their pre-college years (Gitnux, 2023).

Aside from reducing inequalities through employability, learning and using low-code can benefit vulnerable groups in other ways. As we have seen above, engaging non-technical staff, who are directly involved in the operation of the organisation, in the design of software digital applications can help to better meet the needs of both the organisation and the target audience. Thus, NGOs and members of vulnerable social groups can design and develop applications that will support and benefit their communities, thus further promoting their social inclusion.

Last but not least, low code platforms offer features and tools that enable (citizen) developers to create web content that is accessible for all, as we will explore in the next section.

Example: No-code/low-code app development by refugees

As part of the SNHU Global Education Movement, which aims to provide high quality but low-cost education to refugees across the world, Barrett Nash, a Canadian software developer and former tech founder, started to offer no/low code courses to Syrian refugees in Lebanon (Makerpad, n.d).

Not long after, InfiniteUp was created, a no-code/low-code software development house that creates rapid MVPs (minimum viable product) to deploy in the African Market. But what's worth noting is that InfiniteUp was created by Nash, a friend of his and 2 of his students from the SNHU GEM program, Malaz Aroub and Wasim Alshadadi. Furthermore, InfiniteUp team has now been joined by a female student from the program, Hiba Al Fayssal (SNHU Staff, 2021).

Speaking about SHNU GEM and InfiniteUp, Nash said that what convinced him that no-code/low-code skills can really be life changing was when he saw Wasim, who had never developed software before, develop an app after completing a seven-hour training course (SNHU Staff, 2021)!

Reflection Exercise:

Think about what barriers, regarding digital skills, the following social groups might face:

- Women
- Older people
- Persons with a migrant background
- People with lower income
- Disabled people

Which of the features of low-code could help overcome some of these barriers? Reflect also on low-code applications that could contribute to their social inclusion.

3.2.6 User-Friendly Aspects of Low-Code and Accessibility

Before examining how low-code could enhance the accessibility of digital content, we should first examine the user-friendly aspects of low-code in general, what web accessibility stands for and which are its basic principles.

So, let's first look at some of the technical aspects of low-code that make it so usable and appealing (Quixy, 2023):

- Pre-built components: Low code development platforms offer ready-made building blocks and design templates for the user to integrate into their application, such as menus, database connectors, or even entire application templates.
- Visual Modelling: The user has the option to see the structure of their application through graphical representations, without being "lost" between numerous lines of code.
- Mobile app development capabilities: Users can easily build mobile apps without using traditional code.

- Cross-platform compatibility & responsive design options: The applications created can be adapted and operate on different systems and devices.
- Integration with external systems: Low code development platforms offer tools that simplify the process of integrating databases, APIs and third-party services.
- Scalability: Through the provided infrastructure and tools it becomes easier to scale the application according to the needs of the business.
- Deployment options: Flexible deployment options are provided, giving the organization the opportunity to choose where the application will be hosted (e.g. cloud).

That said, how can the aforementioned features contribute to the accessibility of web content?

Accessibility is the process of designing and creating environments, activities, services, and products in such a way that they can be used by as many people as possible (Henry, Zahra & Brewer, 2014). Similarly, web accessibility is the design of websites, tools, and technologies in such a way that they can be used by everyone, and more specifically that people can both navigate and interact with the web and contribute to it (Henry, 2023b). One social group to which accessibility features are addressed is disabled people, i.e. people with mobility, visual, hearing, cognitive and intellectual impairments, and autistic people. However, accessibility features can also benefit other people, such as people with temporary impairments (e.g. broken arm), older adults, people with light sensitivity, people who speak a different language, people who use smaller devices (e.g. mobile phone) or even people who have a slow internet connection (Henry, 2023b). Accessibility is a prerequisite for social inclusion as it contributes to universal access to education, work, health services, leisure, etc., and inclusion as highlighted in the sections above has significant

benefits for both individuals and society, as well as for the economy (Henry, 2023b).

For digital content to be considered accessible it must comply with a number of specifications which are described in detail in the latest version of the WCAG - Web Content Accessibility Guidelines, i.e WCAG 2.2. Some key features that contribute to enhancing the accessibility of digital content will be presented below (Campbell, Adams, Montgomery, Cooper & Kirkpatrick, 2023; Zahra, 2023; Eggert, 2023; Henry, 2018; Henry, 2023a,b)

- Screen reader compatibility: A screen reader is software that converts digital text into audible and/or tactile form and is mainly used by people with visual impairments. Greater compatibility with screen readers is ensured through clear structure, the use of descriptive headings, the use of meaningful texts for hyperlinks and buttons, the correct use of semantic elements, the use of ARIA (Accessible Rich Internet Applications) roles and the integration of alternative text in images.
- Speech recognition/dictation software compatibility: Dictation software is mainly used by people with severe motor impairments who cannot use either a mouse or a keyboard. A prerequisite for using such software is that the accessible names of the buttons, i.e. what a screen reader would read, match the names displayed on the screen.
- Keyboard-friendly design: People with low vision who can't see the cursor or people with mobility impairments that can't use a mouse might use the keyboard to navigate through a website. More specifically they move through the elements of the website by using the "tab" button. Therefore, the web content must incorporate logical tab order.
- Colours and contrast: The use of appropriate colours helps people with visual impairments (e.g. colour blindness) to navigate through the digital content more easily. However, as some people need high luminance (e.g. people with visual impairments) and some people with low luminance

(e.g. people with dyslexia) there should be the option to adjust for both cases.

- Magnification and font-scaling: People with visual impairments use magnification or font scaling for easier navigation. Digital content should therefore be designed to be adaptable and user-friendly even after magnification.
- Use of plain language, clear labelling & instructions, and images: this will help people with intellectual impairments and autistic people, but also people with language barriers (e.g. migrants) to use the web product.
- Compatibility with different devices: Different devices may have different screen sizes and capabilities. Therefore, web content should be adaptable and usable for both disabled and non-disabled individuals.
- Testing: Once the digital product is designed and during its lifespan as it is upgraded, it is important to check that accessibility tools are working properly.

It is important to note that the decision to integrate the above features into web content should be taken during the design phase, as their subsequent integration requires more time (BOIA, 2021).

Accessibility of web content, apart from being an ethical and sometimes legal obligation, has many benefits, as an increasing number of people gain access to information and businesses can reach a much larger audience. However, the features needed to make digital content accessible are many and may require a considerable amount of time and skilled staff to integrate them into the final product, which can result in increased costs. Thus, there is a risk that some organisations may not comply with all accessibility standards.

The use of low-code can contribute to the solution of this problem through the following (Burgoyne, n.d):

- ✓ Integrated pre-built accessibility features: Many low, and no, code platforms have embedded pre-built accessibility features such as alternative text and color contrast settings. This allows developers to use them more easily and thus makes them more feasible for a citizen developer.
- ✓ Automated accessibility testing: There are platforms that also provide automatic testing to ensure that accessibility features are working properly. This is particularly beneficial for digital products that are upgraded regularly and therefore require frequent testing. However, it should be noted that it is preferable to also perform manual checks as automated tests may make mistakes.
- ✓ Responsive design and cross-platform compatibility: There are low-code platforms that offer design options that automatically adapt the layout and UI to different sized screens as well as make the digital content compatible with other operating systems, devices and browsers.
- ✓ Time effectiveness: The simplicity of integrating and controlling accessibility features makes the process much faster, allowing the developer to spend more time on the overall design of the digital product.
- ✓ Reduced costs: Since accessibility features can be used and controlled easily, quickly and by non-specialised staff, the cost of the process is reduced. Thus, even individuals, businesses and organisations with limited financial means can make their web content accessible.

To the above should be added the fact that due to easier learning of low code, the individuals to whom the accessibility features are addressed can actively participate in the design of applications, thus creating digital content that is tailored to their needs.

Example: The most popular mobile operating systems promote accessibility

As soon as we hear the word "app", one of the first things that comes to our minds is Android and iOS. Android and iOS are the most popular mobile operating systems and capture most of the market's share i.e. about 70% and 29%, respectively (Statcounter, 2023). So basically, there is no mobile application that does not work on at least one of the two operating systems mentioned above.

But most apps have elements that are not accessible, especially for people with visual impairments (UW Create, 2021). So, on the Android and iOS websites addressed to developers, i.e. developer.android.com and developer.apple.com, there is a special section which includes basic guidelines which a developer should take into account so that their application can be used by as many people as possible.

You can find the Android and iOS guidelines in the links below:

- https://developer.android.com/guide/topics/ui/accessibility
- https://developer.apple.com/design/human-interface-guidelines/accessibility

Reflection Exercise:

You want to design an app for online restaurant reservations. Reflect and note down what should be included in the app to make it fully accessible and usable for disabled people.

3.3 Conclusion

Technology has rapidly changed the way we live and therefore the way we work. Thus, digital skills are now a prerequisite for finding a job, while many (highly paid) jobs also require coding skills (European Commission, 2017; Gitnux 2023). However, there is still a proportion of people who do not have these skills and it has even been observed that these people are more likely to belong to certain social groups such as lower income earners and women

(Zilian & Zilian, 2020). Hence, these individuals will have fewer opportunities in the labour market, and this will intensify income and social inequalities. A solution to this problem could, however, be provided by low-code. Low-code, thanks to its user-friendly features such as visual modeling andpre-built components, enables even a person without the relevant studies to acquire programming skills and develop applications, since it is not necessary to write endless lines of traditional code (Yan, 2021). This generates a new kind of developer, the citizen developers, who are actively involved in software development without being IT professionals. So, people regardless of their studies and background now have access to coding, gain equal opportunities in the job market and can develop innovative applications that meet everyone's needs. At the same time, even smaller organisations can obtain their own digital tools as application development becomes simpler, faster, and most importantly cheaper (Forbes Technology Council, 2020)! Thus, this democratization of coding boosts innovation, boosts the economy, provides more job and entrepreneurship opportunities, and helps to establish a more inclusive society.

Useful Resources

- Inclusive Labour Markets: Ensuring No One Is Left Behind (Caritas, 2022)
- Diversity Matters (Hunt, Layton & Prince, 2015)
- The Impacts of Low/No-Code Development on Digital Transformation and Software Development (Yan, 2021)
- Vendor Landscape: The Fractured, Fertile Terrain Of Low-Code Application Platforms (Richardson & Rymer, 2016)
- How Shell Fueled Digital Transformation by Establishing DIY Software Development (Carroll & Maher, 2023)
- Web Accessibility (W3C, n.d)

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