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Presentation

*Marco Bocciolone**

I am delighted to accept the invitation to write the presentation for this publication containing the scientific articles developed in the framework of the project *EMotion*. Over my years in office, thanks to the strategic and management plan of the Department of Mechanical Engineering of Politecnico di Milano we have promoted new projects and researches, in particular the ones focused on cooperation and social responsibility. These projects play a central role in line with the University's mission to shape responsible future engineers, architects, and designers. Our faculty, as much as I do, firmly believes that the University is not just about passing on technical and scientific knowledge, but it pursues the final goal of supporting both our students and younger colleagues during their growth path as human beings, social beings, ethical people, and civilians. Therefore, not only studying at University helps to acquire new skills, but also to grow into a more mature person.

For these reasons, I fought hard for this project to be included in the 2018 edition of the Polisocial Awards - the programme of Politecnico di Milano promoting social responsibility. I also shared the tremendous enthusiasm shown by Prof. Susanna Bortolotto of the Department of Architecture and Urban Studies, for years involved in several research programmes on cultural heritage in Eritrea with colleagues from other Italian Universities.

This multidisciplinary project – combining history, archaeology, and technology – relies on the knowledge and the polytechnic scientific rigour typical of architecture and engineering. Its goal is to define new concrete growth opportunities in Eritrea, in terms of infrastructures, technology, and learning. In other words, thinking about how to improve the mobility of people and goods while safeguarding, preserving, and enhancing their cultural heritage and landscapes.

EMotion's outputs are proposals comprising measures based on state-of-the-art skills, know-how, and actions that, with many delays and difficulties, the western world has already started adopting to ensure a sustainable future. Once implemented, they will immediately benefit the African continent and its development.

However, plans and proposals do not mean cooperation. Acting is necessary, this is how the project VITAE sponsored by AICS (Italian Agency for Cooperation and Development of the Ministry for the Foreign Affairs and International Cooperation) was born. A three-year operational project “*EMotion* compliant/inspired” aimed at building a sustainable archaeological site in Adulis (Eritrea), where the local cultural heritage will be preserved along with the environment by the usage of renewable energy and the implementation of water management and mobility plans.

Marco Bocciolone



Presentation

*Fessahazion Pietros Menghistu**

The present publication on “*EMotion* - Eritrean Mobility and Cultural Heritage. New Frontiers of the Horn of Africa”, in line with the last Scientific Report of *EMotion*, is a clear testimony of the dedication, commitment, enthusiasm and hard work of its authors, to whom I would like to express my sincere appreciation and gratitude.

As Ambassador of the State of Eritrea to the Republic of Italy, I feel very honoured to present this informative book on my country to the public. It is my belief that scholars and readers in general will find it of particular interest.

Moreover, I am pleased to avail myself of this opportunity to acknowledge the valuable contribution of the Politecnico di Milano, the authors of the publication, all the institutions and individuals directly or indirectly involved in the commendable effort of providing researchers and other interested people with additional information, and in-depth knowledge of Eritrea’s ancient history and cultural heritage, its ancient caravan trade routes, its present-day transport infrastructures within the scope of a wider African context, as well as the ongoing and future development endeavours in spite of the existing formidable challenges.

Fessahazion Pietros Menghistu

* Ambassador of the Eritrean Embassy in Rome



Presentation

*Marco Mancini**

As new Ambassador of Italy to Eritrea, I am pleased and honored to present this book on the *EMotion* Project realized by the Politecnico di Milano as one of my first acts in this Country.

The book illustrates the combined efforts of a team of Academics and scientists belonging to four different Departments of the Politecnico to give birth to this formidable project.

I've had the opportunity to travel along the Asmara-Massawa road yet only for a short stretch, but I've already been captured by its fascination that brought me back to historic and cultural recollections about a Country of special importance for Italy and the Italians.

The Project's aim is to revitalize this crucial road making it a model of smart mobility while preserving the cultural and naturalistic heritage of the Region it crosses. To modernize it with the most advanced ICT technologies, renewable power sources and sustainable maintenance is like bringing to new life a masterpiece of engineering and architectural expertise, a source of pride for the Italian and Eritrean people who contributed to its edification decades ago.

The main distinguishing feature of the *EMotion* Project is its multidisciplinary approach that takes into consideration all aspects of life that will be concerned by its completion (social, economic, cultural and more). Furthermore, this new approach can and should be replicated for other future projects in the field of smart mobility, in order for it to become a model and an icon.

These are principles upon which both the UNESCO Convention of 1972 and the Eritrean "Cultural and Heritage Proclamation" of 2015 are based and that have inspired the tireless work of the Politecnico di Milano to elaborate *EMotion*.

Concrete steps have already been taken towards the Project's implementation. Let me mention the one week training course held in Asmara at the beginning of this year, titled "Preservation and Reuse Project", as a useful occasion for sharing technical aspects and comments between the Eritrean and Italian institutions involved. My personal thanks go to the Commission of Culture and Sport in Asmara who made this gathering possible.

The end of the Covid-19 pandemic will hopefully mark a concrete start for the *EMotion* Project, bringing together men, materials and expertise of both our Countries to make this project come true.

With this wish and my personal and active engagement to support the Project's best outcome, I would like to express my grateful thanks to the Politecnico di Milano for its contribution in building a new bridge of friendship and collaboration between Eritrea and Italy.

Marco Mancini

* Ambassador of the Italian Embassy in Asmara



Eritrean Mobility and Cultural Heritage. New Frontiers of the Horn of Africa.

An overview of the project

Susanna Bortolotto
Federico Cheli

Territorial outlines and communication in their historical context

Eritrea is located on the western side of the Red Sea along over one thousand kilometers of coastline. It borders with Ethiopia and Djibouti to the South and with Sudan to the West and the North. The closed inland is made up of a lightly wrinkled plain, where the main landscape goes from the bushy steppe, typical of semiarid contexts, to the rocky deserts and torrid depressions of Dancalia. Mountainside slopes start rising from the coastal lowlands towards the Eritrean plateau, which reaches an altitude of 2,000 meters above sea level (MASL). The edge of the plateau is an important watershed: the water courses, which are all seasonal, starting at the east of this line reach the Red Sea, while the others run towards the western lowlands (with important towns such as Keren, Agordat and Tessenei) in direction of the river Atbara, a tributary of the Nile. In the forty-kilometer wide strip of land between the mountain edge and the sea, the differences in elevation generate a climatic variety (dry and hot summers on the coast; humid and fresh on the highland) consisting also of different pluviometric regimes: in the lowlands it rains in winter, on the highlands winters are dry while in summers heavy and sudden showers occur. This double pluviometric regime has made these two regions complementary, and the average elevation area, which goes from 850 to 1.100 MASL, takes advantage of both.

Starting in antiquity, thanks to their strategic positions the main landing places of the Eritrean coast have been connections between important sea-routes and inland trade routes going to the highlands towards the internal areas of the African continent. In ancient times, the key link between sea and inland was the *emporium* town of Adulis and the camel track connecting the Zula Bay (Red Sea) to Toconda, Qohaito,

Keskese, Matara and Axum¹. In more recent times, Massawa became the main harbor town and commercial spot supporting trade with the highlands. The relevance of this network was defined by the complementarity of traditional economies along the coast, trade in Massawa, and agriculture production on the plateau.

In the regional network, the road connecting Massawa, i.e. the main national harbor, to the capital Asmara is a quite recent route. Along its 120 kilometers it exceeds a difference in altitude of 2,300 meters, going through an articulated sequence of cultural and natural landscapes: “three seasons in two hours” is still a common saying about a travel from Asmara to Massawa.

Concerning transport infrastructures, it is necessary to underline that the Asmara-Massawa axis was constituted not only by a road: in 1911 the two towns were connected also by a narrow gauge railway that served as transport for most of the people and goods, and was partially rehabilitated by the Eritreans in 1994-2002 and is nowadays used only by tourists from Asmara to Arbaroba, about 18 km. In 1937, a 70 kilometers long ropeway was completed that was able to carry more than 300 tons daily². The ropeway’s activity came to an end very soon and in the Sixties the line was dismantled.

The Asmara-Massawa road in the current Eritrean context

The main traffic of the road is currently constituted by heavy vehicles coming from Biscia mines and directed to the Massawa port (about 300 km). Besides this long distance travel, the road is subjected to different kinds of local traffic related to local settlements: pedestrians, cyclists, camels, donkeys and carts, mainly moving to reach primary services like schools, medical centers, safe water, local markets, or grazing and water spots for animals, or cultivated fields. The mixed traffic is less evident in the lowlands because the orography makes it possible for pedestrians to use side-tracks. There is also regional traffic: Asmara and Massawa are in fact the most important towns in Eritrea as they are home to hospitals, high schools, public offices, etc. The important weekly market in Ghinda, halfway down the road, attracts an important amount of people from the wide area. The Ali Hasa, Dongolo, Sabarguma and Ailet hot springs, therapeutic for muscles and skin diseases, are other regional destinations³. Along with Nacfa and Afabet, in the northern regions

of Eritrea the road is the location of the most relevant Liberation Heritage sites, and every year in February the Asmara-Massawa is travelled by thousands people from all over the country to participate in the Fenkel, the commemoration of the freeing of Massawa in 1990 and decisive to the freeing of Asmara and Eritrea. This is also the road mainly taken by tourists who arrive to the Asmara Airport, the only international airport in Eritrea, and often have Massawa as second destination: from here it is possible to reach the Dahlak islands and the archaeological site of Adulis.

The Asmara-Massawa road in the African context

In the complex African context, the shared idea is that the development goals of each single country related to the variety of resources of the continent can be enhanced by being linked to each other. That is the reason why many efforts have been made in the last decades to design and build a transcontinental network facing infrastructural issues in Africa as a whole. *African Union* has identified in infrastructure continental integration the most important component to fulfill the African economic and productive potential⁴.

Hence comes the interest for cross-border road corridors and for transcontinental highways connecting national economies with the support of governance strategies and policies, such as the “African Continent Free Trade Area” (AfCFTA), which deals with trade and customs agreements for the free transfer of goods in the continent: the aim is to facilitate the connection of landlocked regions to the sea and to integrate the enormous resources and productive capacities of Africa. Eritrea is not part of the trade agreements, and none of the corridors designed in the last decades go across Eritrean borders⁵.

The borders with Ethiopia were re-opened in 2018 following the acceptance by Ethiopia of the peace agreements of Algiers dated 2000. Initially, this reconciliation made the international observers suppose that Ethiopia, which is a very wide landlocked country, for its northern regions would have used the Asmara-Massawa road to reach the port, via Adua-Asmara or Adigrat-Decamere-Nefasit, using Djibouti for the central and southern regions, and taking advantage of Assab harbor for small trades via Dessiè. The commercial border between Ethiopia and Eritrea is currently

closed, consequently such an increase of traffic that could turn the Asmara-Massawa road into a highway has not come yet.

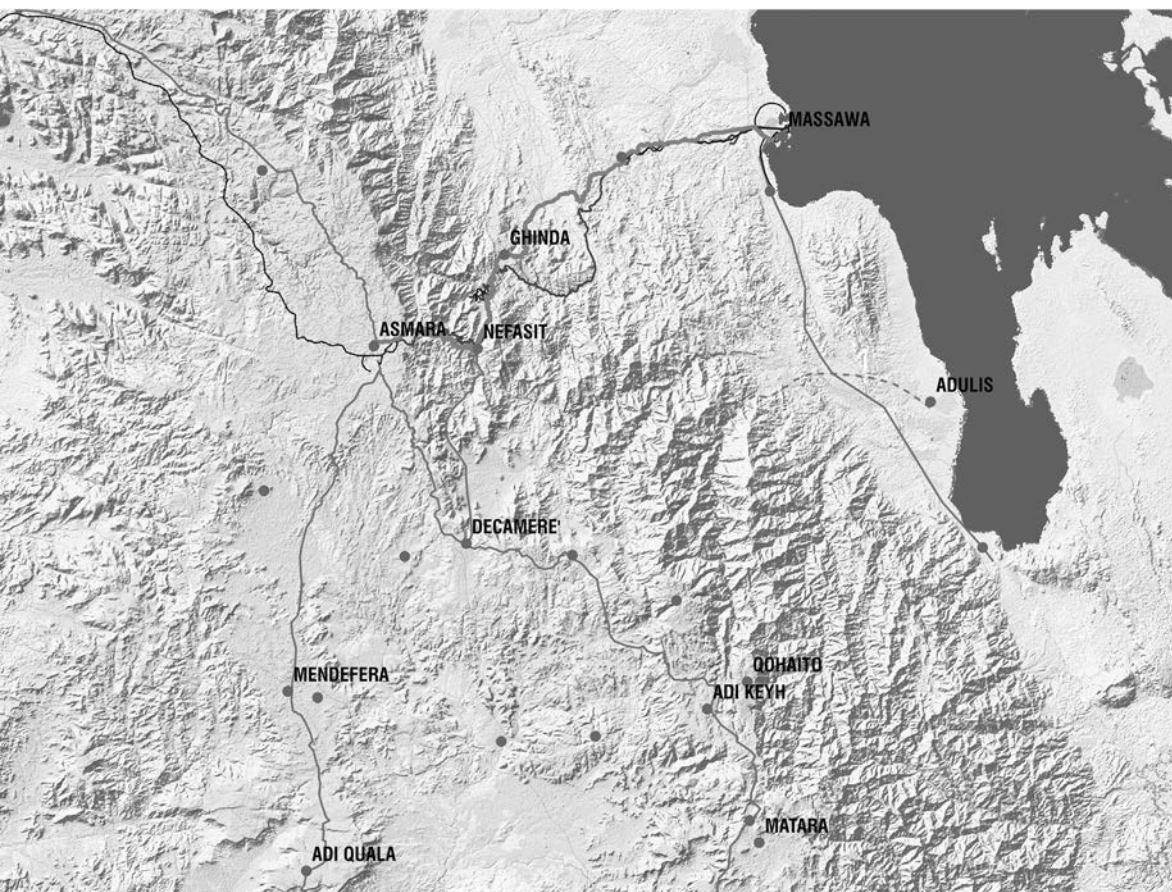
At the present time the road is mainly used for connecting coastal lowlands and highlands, and for national transfers, among which of Biscia mine production (gold-copper-zinc) and Zara mine supplies (machineries). Most of the imported goods are delivered in Massawa, so that the road is also the main route for national supplies. Nevertheless, the road is still a strategic asset of paramount relevance in the Horn of Africa and the traffic flow will certainly increase. It is therefore important to take advantage of the current context to design and consolidate a tailored and appropriate mobility system able to manage increasing traffic flows and to safeguard the existing infrastructures and the characteristics of the interaction of the road with its surroundings: unlike a highway this road is extremely permeable to side areas. Moreover, this new mobility system should be designed to serve and enhance local communities and not to create problems or damages or danger (noise and air pollution, traffic etc.).

The road and its current use, an overview on its future development

No data are available on road accidents in Eritrea, but the most vulnerable categories (i.e. children, elders, disabled people) are obviously in danger in a context which is not equipped with night lighting, protection, speed reducers, rescue lanes etc.⁶ It has to be reminded that there is no electricity grid outside of Asmara and Massawa, so there is no immediate possibility to power signals or active control devices. Neither is it possible to take advantage of ICT-based control systems, as there is no internet network except a slow and inefficiency one, available only in Asmara and Massawa. «According to the *International Telecommunications Union* (ITU), Internet speeds in Eritrea are among the slowest in the world [...]. Internet connection is through expensive and slow satellite communication»⁷ and it cannot be extended to the entire nation. According to ITU data⁸, in 2017 only 1,31% of the Eritrean population used internet, with a previous growth rate of 0.1 % a year (in Ethiopia in the same year the amount was 18,62%, in Sudan 30,87%, in Djibouti 55,68%).

The Government seems to be interested in providing a good, fast and reliable internet

network to the country by setting up an «ultra-modern IT infrastructure system [...] using Eritrean ‘solutions’ in areas of design, implementation, maintenance»⁹. The Engineer Samare Zarou points out that the lack of reliable and fast connection is one of the main deterrents to foreign investors, but it is also the limit to knowledge and skill development of young people that makes ICT infrastructures the next challenge that the nation has to face. The objective is to set a net of optic fibers taking advantage of the long Eritrean coastline to intercept one of the thirteen submarine cables in the Red Sea (Port Sudan, Djibouti and Somalia are in fact connected, but close to Massawa no junction access point has been set). His proposal is to connect to the best submarine line and to set cables along the poles of the no longer used



electricity line from Massawa to Asmara. «A bundle of fiber optic cables that would meet every data transfer requirement of Eritrea could actually be pulled over from Massawa to Asmara on the existing electric power line poles [not used] without the need to dig trenches or build new towers»¹⁰. In such an acceptance the Asmara-Massawa road would become a backbone: as in the past it was a transport axis, it would now become the first Eritrean ICT line. Regarding electricity, it would be then possible to design local grids powered by renewable sources such as sunlight, wind and water (numerous dams have been built in the last twenty years). It would be therefore possible, by using ICT, to solve several problems related to isolation of smaller settlements and to the lack of widespread services. If integrated in the design of smart mobility, it would be possible to track and monitor heavy vehicles and to run the public transport fleet in order to manage and optimize the service. These issues are not so different from those of the Italian “internal areas”, which in fact have been approached through the enhancement of accessibility to services and connectivity to reduce depopulation of isolated territories.

The aim of the “Eritrea Mobility and Cultural Heritage. New Frontiers of the Horn of Africa” (*EMotion*) project¹¹ is therefore to serve this consolidated corridor and test it for a new mobility focused on the services for the local communities, on the conservation of the infrastructure and on the safeguard of the cultural landscape. The intention of this approach is also to focus on the relationship between road and context, which would totally change if the truckway turned into a high-speed highway. The conservation of the road as it is, is fully encouraged by the results of this research, which recognized the importance of this “monument/document” in the history of Eritrea and of Engineering¹².

Need assessment and objectives

Eritrea achieved its independence in 1991 after thirty years of war with Ethiopia. As already mentioned, in 2018 the borders with Ethiopia were re-opened, but currently the commercial border is closed, therefore, an increase of traffic is still to come. At the present time the Eritrean road is mainly used for connecting coastal lowlands and highlands, and for national transfers, but we must keep in mind that the road will be a strategic asset of paramount relevance in the Horn of Africa.

The challenges of the *EMotion* Project are a new mobility preserving the pre-existing

historic infrastructure: an extraordinary and vulnerable cultural heritage. It consists of a unique road and railway network crossing natural and cultural landscapes and connecting archaeological, historical-artistic and architectural sites; but above all it is itself the summation of artefacts and monuments to be preserved, protected and enhanced.

The main axis considered in this project is the Asmara-Massawa road: 120 km, difference in elevation 2,300 m, single carriageway, with about thirty civil important historical structures. Besides being a road for trade and transport, this strategic axis represents an extraordinary opportunity to design an original and innovative itinerary.

The new model of smart mobility and the possible future vision of the project can represent the ideal and real bridge, capable of transferring knowledge, goods, ideas, values and of connecting people, as well as reuniting historically and culturally related places and paths. The new role of infrastructures will be pivotal.

The historic system of the colonial period can now become an instrument of valorization and commercial/cultural/touristic development, but it needs to be safe, equipped, easily accessible and managed with sustainable mobility criteria.

A key factor therefore is the role of the transport network, which will have to be designed taking into account the current meaning of sustainable mobility, which must consider the development policies of urban and territorial areas, cultural heritage, energy efficiency and environmental quality and its replicability in other contexts.

The *EMotion* project aims to provide a set of integrated solutions for sustainable development, for the valorization and fruition of cultural heritage through the activation of innovative high-profile research lines, thanks also to the contribution of the stakeholders, partners and companies involved.

State of the art and innovative features

Eritrea is a key country in the strategic area of the Horn of Africa. In November 2018, after peace with Ethiopia, also all United Nations sanctions on Eritrea were lifted. It is therefore even more crucial to solve the problem of physical and cultural barriers contributing to the creation of an integrated continent, also as indicated in the “priority area” of *Agenda 2063* (Aspiration 2), exactly: “Communications and

infrastructure connectivity”¹⁵. A big and urgent research question now is the role of a sustainable transport and mobility in the Horn of Africa, that «can enhance economic growth and improve accessibility [...] better integration of the economy while respecting the environment, improving social equity, health, resilience of cities, urban-rural linkages and productivity of rural areas» (*Agenda 2030*, Goal 11)¹⁴, also giving value to cultural identities and heritage (*Agenda 2063*, Aspiration 5)¹⁵. Among the new relevant literature for this area is the Italian Institute for International Political Studies (ISPI) Dossier¹⁶.

In this geographical context, the *EMotion* project aims to carry out a feasibility study to support the challenge of promoting mobility on the Asmara-Massawa route, also enhancing and protecting the historical elements of cultural value of the route itself and of the areas it goes through.

A set of actions has provided the advancement of the state of the art. Among these actions, significant has been the construction of an operational atlas for the knowledge of the territory, with the inventory of the heritage in GIS environment, to support the future maintenance strategies, the management of risks and the new needs. Important has been not only the knowledge of the Asmara-Massawa case study as cultural heritage that combines tangible and intangible elements, but also the analysis of the characteristics of the structures along the road in relation to the current mobility needs and the study of the current flows of goods and people and of future scenarios (also the planning of tourist itineraries)¹⁷. The best practice defined for the Asmara-Massawa road case study regarding mobility is central to the preservation, valorization of heritage and sustainable development of the communities.

Research group, multidisciplinary, added value

EMotion is compliant, as already said, with a comprehensive multidisciplinary approach addressing heritage, construction and materials, environment, mobility, energy, management and social impact. This approach combines theories, methods, tools and techniques from humanities, engineering, earth sciences, technologies, providing new information and a general model that can be applied to other context and replicated by expanding case studies.

Four are the Politecnico di Milano Departments with specific competences and expertise relevant to the research project and necessary for developing it: Department of Mechanical Engineering (DMEC), Department of Architecture and Urban Studies (DASU), Department of Civil and Environmental Engineering (DICA), Department of Energy (DENG). The multidisciplinary team took care of:

- protection, safeguarding, preservation, conservation, reuse, valorization of cultural heritage and landscape;
- assessment of existing infrastructures;
- development of intelligent transport systems;
- definition of possible retrofitting strategies considering durability and sustainability issues;
- maintenance of infrastructures and vehicles in a peculiar morphological (landslides, slope instability effects, drainages) and geophysical area as the rift Valley/African plate;
- management of physical and virtual flows with databases of logistics in situ, economic planning;
- outcomes on training;
- scientific and public dissemination.

In this context, in 2018 the Italian Ministry of University and Research (MIUR) named DMEC, DENG and DASU *Departments of Excellence* for the respective projects: “Lightweight and Smart Structures for Industry 4.0 in Mobility Applications” (DMEC); “Energy for Motion” (DENG); “Fragile Territories” (DASU).

The *EMotion* project involves a wide range of skills: cultural heritage conservation, new solutions for sustainable mobility, analysis of the structural reliability of road infrastructures. A synergy among stakeholders, university, partners and companies has been fundamental¹⁸.

Description of the activities and results

In addition to the normal “assessment” activity – which included the organization of the entire program in relation to budget conformity and relationships with stakeholders, universities, partners and companies – the first step of the *EMotion* project was acquiring “knowledge” about territorial context, mobility system, road

axis and all the existing infrastructures, crucial for identifying the elements to be analyzed and for designing transformation strategies and itineraries related to cultural and natural heritage.

This phase of the research work completed the collection of the necessary information for the development of the research project¹⁹. After, *EMotion* focused on a “case study”: the Asmara-Massawa road. The aim was to combine the safeguard of its significant elements and the application of the highest standards of TS criteria²⁰, considering that the highway is at the same time a commercial axis and a connection of cultural and natural sites. Specifically, the research activities have been planned as follows:

- analysis of the road to identify cultural and natural heritage systems, overlooks upon the landscape, and locations for starting new itineraries;
- assessment of the geomorphologic conditions of the mountainsides along the road;
- identification of the most appropriate techniques for the knowledge of the actual structural condition of historical infrastructures and for the state of conservation;
- evaluation of the traffic flow and the presence of mixed traffic;
- knowledge and design of the monitoring system to define a possible intervention plan for the structural retrofitting of existing infrastructures, preserving the cultural heritage and ensuring safety;
- study and project of the ITS²¹ based on the assessment of the actual state of the network, and consistent limitation of maximum loads;
- energetic efficiency enhancement of bus fleets; electric hybrid solutions have been evaluated to reduce polluting emissions and promote environmental sustainability;
- analysis of heavy-goods-vehicle-fleets management for improving efficiency, productivity and reducing the overall transportation and staff costs; an advanced fleet management system will allow the prediction of asset lifecycles based on costing information, utilization, and asset age;
- evaluation of the energetic efficiency enhancement of heavy-goods-vehicle-fleets; electric hybrid solutions will be valued basing on the traffic flow analysis to optimize energy efficiency of heavy-goods-vehicles so as to reduce fuel consumption and enhance environmental sustainability.

All these studies on state of the art and knowledge have transferred important “suggestions” and feasibility bases for the project, among these:

- enhancement of the cultural route and the heritage of the surrounding area;
- increasing connectivity among the local communities in the new functional system;
- economic and employment growth promotion of all the satellite activities through development of efficient infrastructures;
- protocol set-up useful for the structural proofs of civil works, for conservation, consolidation and planned maintenance of artefacts, respecting their historical characteristics and minimizing the invasiveness of the interventions, while guaranteeing an adequate level of transport safety;
- configuration of protocols for the creation of a modern approach to mobility, rationalizing traffic, reducing pollution and enhancing connection possibilities;
- evaluations of the applicability to other communication routes with similar characteristics.

Among the *EMotion* activities there has also been the organization of a “training program”. In January 2020, luckily before the Covid emergency, it was possible to organize a one-week course at the *Commission of Culture and Sport* in Asmara²².

And finally, “dissemination” has been an important support of the project with reports, book editing, workshop and conference organization, interviews, press and web releases²³.

The Politecnico group focused on the search for new lines of financing and grant opportunities with the aim of creating a partnership for future projects that involve local stakeholders. All this in order to implement the priorities that emerged in this project and to generate new research, driving investments with the development of local and Italian entrepreneurship in the multidisciplinary field of the project, particularly through activated scalar and replicable research lines.

Therefore, it is possible to apply the logic of analysis and intervention developed for this project in similar contexts and in other countries; the opportunity to create an international partnership working on the topics covered by this proposal, with funding opportunities for the continuation of the research²⁴.

Social relevance of the research and expected impact

A first outcome of this project has been the proposal design of solutions compliant with “ITS criteria” for some part of infrastructures of the road. This will be able to support the public and private bodies in the design of a new, safe, efficient and sustainable Eritrean mobility system, ready to encourage the new strategies for the preservation, maintenance and valorization of cultural identities. In this context the research and the transfer of technologies play a pivotal role suggesting a development model balanced with environmental and social sustainability. Moreover, the companies involved in this project have been able to advance, thanks to the detailed analysis, to the challenging case of the Asmara-Massawa road, potentially a first stone of a wide-range application of a sustainable mobility approach in rural areas. Heritage and Mobility are strategic resources favoring social and economic development and enhancing the quality of life. The joint and coordinated work designed by this project, together with the integrated accessibility, will contribute to increase productivity and generate economic growth, ultimately providing great benefits to the community.

Present and future generations will benefit from the improved quality and safety of their urban and territorial environment. The sustainable development of the cultural heritage industry and satellite activities will create new jobs, new professional profiles and skills, and will establish the premises for the development of local and international tourism, with advantages for wider categories of the population.

The long-term result will be a significant improvement in the services and, consequently, in the quality of life for its citizens and visitors.

Asmara-Massawa can be defined a “Cultural Route”, demonstrating, via the journey through space and time, how the heritage of the different peculiar regions in Eritrea contributes to a shared cultural heritage. The project is a channel for intercultural dialogue and promotes better knowledge and understanding of Eritrean cultural identity while preserving and enhancing natural and cultural heritage.

A cultural route is physically determined and characterized by having its own specific and historic dynamics and functionality; showing interactive movements of people as well as multi-dimensional, continuous and reciprocal exchanges of goods, ideas, knowledge and values within or between countries and regions over significant periods of time; and thereby generating a cross-fertilization of the cultures in space

and time. In view of its size effect, cultural routes contain various values in history, society, culture, art and related information. For these reasons, the case study could be the preparation of a new UNESCO site in Eritrea – with a proposal to the *African World Heritage Fund*²⁵ – if this is one of the Eritrean socio-political priorities. The development of the project – thanks to the recent joint declaration of peace and the lifting of the embargo on Eritrea – will have (hopefully in the near future) a renewed and decisive geopolitical significance in the Horn of Africa.

With regard to the above and considering the current extraordinary area of international cooperation and competition and the future dynamism of these regions, the Asmara-Massawa axis will be an essential component for the development of Eritrea. At the same time, development, especially when it is fast and difficult to control, could be the cause of irreversible damage to cultural landscapes, to a fragile territory and to social relations, which are of paramount importance in a community-based social system.

Providing support in managing the road, its maintenance, its traffic flows in a sustainable perspective, along with the safeguard of the cultural landscape, means providing tools to manage the development to come, and to promote awareness of its critical implications.

The setting up of this management involves different skills at various level, as the project deals with the infrastructure itself and its maintenance, with means of transport and all the satellite activities, with touristic facilities, and with the enhancement of cultural and natural heritage.

The network of cultural and natural areas along the axis Asmara-Massawa involves a corridor that could be in some situations several kilometers wide, as the road and touristic services facilitate access to scattered side-sites. This new attention to previously marginal and neglected areas can provide alternatives to their progressive abandonment.

Appropriate mobility is a key issue in the area. It will enable inhabitants to reach hospitals, schools and community services, by providing safe, suitable and sustainable mobility strategies. For entire communities it will be easier to reach traditional worship and gathering places, leisure areas like hot-springs and the seaside, cultural sites, markets etc. Providing mobility solutions to be shared with local and international visitors will open touristic circulation, which is now directed by a limited number of travel agencies, and local economies will benefit from it²⁶.

EMotion, hopefully, will be able to support the local public institutions in testing and proposing rules and regulations concerning interventions on the built heritage and to develop sustainable procedures regarding monuments/documents, territorial preservation and smart mobility.

The improvement of the access to services for the community is related to mobility, security, communication, training, cultural and touristic fruition. In detail the project will be able to contribute to developing strategic planning supporting decisions, processes and consequent strengthening of social impact for the beneficiaries, maximizing the efficiency and effectiveness of activities.

Strategy for scalability. Eritrean Heritage: sustainable valorization Asmara-Massawa-Adulis and VITAE new project

The historic city of Massawa is the arrival point of the Asmara/Massawa road, *EMotion's* “case study”. The city and its important natural parks (Dahlak Islands, Buri Peninsula, Semenawi Park) are considered areas of priority interest in local development plans.

The road from Massawa to the South, after 50 km, reaches the village of Foro, whence the 6 kilometers track that leads to Adulis starts, an important archaeological complex in the Horn of Africa, where the Politecnico di Milano – with important Eritrean institutions and other Italian universities – has been operating since 2012 in agreement with the Research Center on the Eastern Desert (CeRDO). This is the theme recognized as a new design idea, inherent to the ongoing research, to implement its scalability.

In Adulis and in its link with a strategic axis Asmara-Massawa, a local development plan has been identified based on the sustainable enhancement of cultural heritage combined with environmental protection with the use of renewable energy, water system management and mobility.

The first of these aspects concerns the accessibility of primary services by the communities: from Foro to Zula the track is passable with off-road vehicles; only on foot or by dromedaries is it possible to reach the village of Afta, located north of Adulis. Meetings with local stakeholders have highlighted that the Massawa-Foro-Zula-

Adulis-Afta road is now unpaved and often interrupted by seasonal floods and its accommodation is the priority need of communities for accessing basic services. Furthermore, connecting the archaeological site – and natural parks mentioned – is crucial for the enhancement of tourist itineraries and for their fruition, but above all for the sustainable development of the territory.

The *EMotion* team, Research Center on the Eastern Desert (CeRDO) with other partners and local stakeholders have prepared a feasibility plan to create an archaeological and natural park, enhancing the extraordinary historical evidence and the agricultural landscape. This new idea has been the premises of the new *VITAE* project, submitted on 25/11/19, after the invitation of the Italian Agency for Development Cooperation (AICS), with a financing of 2.3 M Euro approved on 18/12/2019 with agreement signed on 22/05/2020²⁷. The goal of *VITAE* is the preparation of integrated solutions for sustainable development, the enhancement and fruition of cultural heritage, creating a better quality of life for the communities through the implementation of Politecnico di Milano activities with local stakeholders. The new design idea – following the historical corridor, the “case study” of *EMotion* – will treasure the Eritrean cultural heritage from the plateau to the coast, from Asmara (UNESCO site since 2017) to Massawa and then proceed to Adulis.

The axis Massawa-Foro-Adulis will follow up the corridor Asmara/Massawa to implement not only the local development plan based on the sustainable enhancement of cultural heritage combined with environmental protection, but will also be able to satisfy a priority need of communities for accessibility to primary services.

Eritrean laws on heritage issues and development plans

Eritrea adopted the internationally used tools for the protection of cultural and natural heritage, including the UNESCO Convention dated 1972 – *Convention concerning the protection of the world cultural and natural heritage* – and the one issued in 2003: *Convention for the safeguarding of the intangible cultural heritage*²⁸. The “Cultural and Natural Heritage Proclamation” n. 177/2015 indicates the Eritrean Government’s serious interest and commitment in the preservation and conservation of cultural and natural heritage. The document also states that: «the sustainable protection, safeguarding, preservation, conservation, promotion of, as well as the

dissemination of knowledge and practices on the country's Cultural and Natural Heritage is beneficial for the social, economic, intellectual, artistic and cultural development of the current and succeeding generations».

In "Article 2" of the law it is possible to read the definition of *Built Environment*, it «means human-made resources and infrastructure of cultural, aesthetic, architectural, historical or other significance designed to support human activity, such as compounds or ensembles of buildings, roads, gardens, parks and other amenities».

The Proclamation also defines *Cultural Heritage* as «any tangible or intangible resource which is the product of human creativity and labor in the discernible historical times describing and witnessing to such creativity and labor because of its scientific, archaeological, historical, cultural, artistic, architectural or aesthetic value or content ultimately bearing [this is important] the identity and/or collective memory of peoples or communities». Among these documents/monuments of cultural heritage, the Eritrean people include also the « immobile colonial heritage resources such as building structures, monuments, engravings, marketplaces and important landmarks such as public squares, boulevards, etc. ». We want to remind you that Asmara, exceptional example of early modernist urbanism at the beginning of the 20th century, became a UNESCO site in 2017 thanks to the Eritrean community. Interesting is also that "mobile heritage" includes «old railways [and] antique vehicles, etc.» such as steam trains, *littorine*, *FIAT Cinquecento* and so on.

The recent insertion of Asmara, "A Modernist African City", in the World Heritage list makes us understand how the Eritreans appreciate colonial heritage as a historical heritage of their country²⁹, an extraordinary heritage that is still "functional", benefit of local communities. These artifacts are certainly bearing their own historical memory, with a specific material consistency and technological knowledge of the Italian ex-colony, but their protection is an entirely Eritrean choice.

This choice also considers the socio-economic aspects, given their use in everyday life, also validating in some way their sustainability in conservation actions.

The protection of these fragile "complex colonial assets" – from the cities with their architectures and open spaces, to the infrastructures with their important civil works (bridges, viaducts, tunnels, etc.) – on the one hand enhances their cultural aspects (also tourist) and local landscaping, and on the other hand puts a brake on the subtraction/demolition of the historical building inseparably linked to its

context. It is a heritage that contains within itself memories of a story – the colonial one – certainly troubled, however now considered part of a history not only not to be forgotten, but also to be appreciated as a resilient work of “shared culture”³⁰.

Conclusion

The knowledge activities of the *EMotion* Project can be considered fully accomplished: weaknesses and potentialities have been pointed out, and possible solutions have been identified.

The point is now to understand which possible future scenarios can enable Eritrea to move towards a smart and sustainable mobility between Asmara and Massawa, according not only to the current situation (the contributions, in this book, have attempted to answer these questions), but also according to priorities, ambitions and wider needs declared by Eritrea.

How can the road be configured to become a backbone of infrastructures and services? Which elements of the landscape system would it affect? What would be its impact? How could it contribute to the well-being of local communities enhancing without threatening their cultural landscape?

In the design process, which has been carried out along with partner companies, possible medium and long-term scenarios have been identified.

The objectives, methodologies and results of the *EMotion* project – also outlined thanks to the contribution of the Eritrean stakeholders – may result in a sustainable development model. It will be preparing for the future changing of behavior and actions, premise to the transformation of quality of the economic and social processes with an impact on the community.

Finally, *EMotion*, reflecting on the “new” role of historical infrastructures between conservation and development, hopes it can (as states the *Charter African Cultural Renaissance*, 2006): «develop all the dynamic values of the African cultural heritage that promote human rights, social cohesion and human development»³¹.