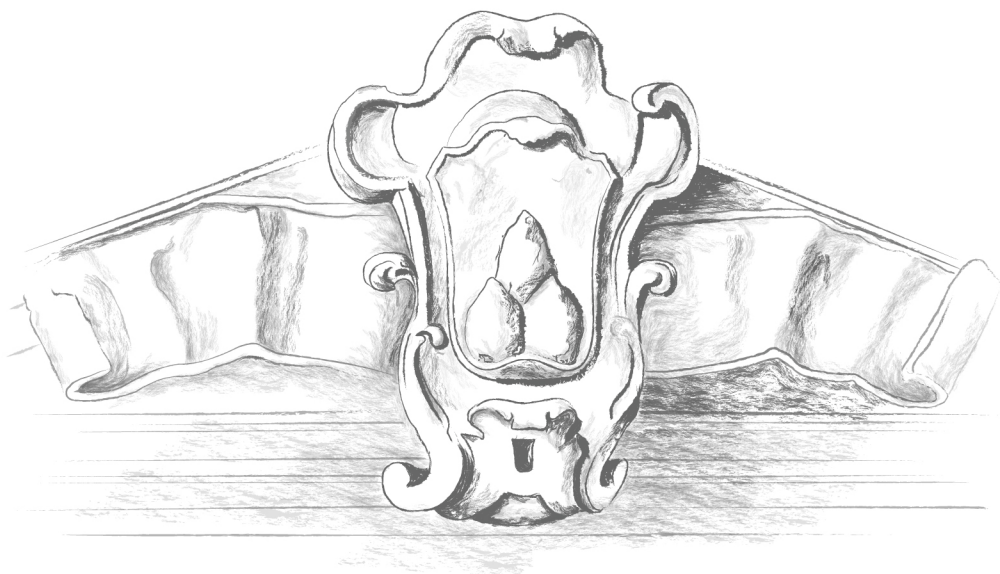


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Front page illustration - Detail of the coat of arms above the main entrance of the Banca Giuratale, Independence Square, Victoria, Gozo.

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The Monte di Pietà in Gozo 1910-1939: A Social Perspective

The Inception of the Monte Part 1

Pauline Vella

Abstract:

The history of the *Monte di Pietà* of Gozo has not been treated in Maltese history barring some cursive references in a few history books. Consequentially, one of the main problems was the lack of sources, especially secondary sources. The primary sources researched were the actual pawning tickets which had never been researched before; material which had been rescued from certain destruction in the hands of mould and neglect.

After exploring the *Monte's* inception and *raison d'être* together with the administrative aspect and perspective, the research moves on to its more important issue: that of the actual clients of the *Monte* and tries to understand the how and why of its usage. Gender and family issues come into relief in such a work necessarily set against geographic, seasonal and economic backdrops to these pawning activities. These conditions include the economy of the Maltese Islands, the nature of the work carried out by the inhabitants, employment opportunities or lack thereof, personal and family lifecycles and annual religious feast cycles. Another area which is investigated to complete the picture is familial and neighbourhood networking which supported pawning activities.

However, for this two-part article, the focus is on the *Monte di Pietà's* origin and function.

Keywords:

Monte di Pietà, Pawning, Neighbourhood networking, Role of women in the family, Gozo.

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The Monte di Pietà in Gozo 1910-1939: A Social Perspective

The Inception of the Monte Part 1

***The Monte di Pietà*, its origin and function:**

The *Monte di Pietà* is typical and atypical of the other charitable institutions on the islands. The *Monte* is typical in that it emerges as a charitable institution with the aim of providing petty credit for the needy, who would make morally correct usage of it. On the other hand, it is also atypical as the only charitable institution that had some sort of income to its credit. It was a form of banking facility – it gave a small-scale loan against a pledge to satisfy daily or petty needs. This institution had been developed by the Catholic Church and encouraged by the state in Western Europe as a form of empowerment through pledges as opposed to begging. The recipients of such charity had nothing to be ashamed of as they were not receiving charity in the traditional and literal sense but were pledging themselves for the repayment of the loan and paying an interest for its safekeeping. In this way, the lesser poor could turn their goods into collateral and work towards redeeming them. This, as opposed to other charities, gave dignity to its recipients and it also gave them a goal towards which they could work. Nevertheless, the authorities did not try to tackle the problem

of poverty at its grassroots; they only differentiated between the deserving and non-deserving poor and gave the lesser poor the opportunity of pledging at this institution. The amount advanced was always less than the value of the actual pledge as the tendency was towards undervaluing an object for the institution to remain covered. This practice also fit the principle that pawning was there to avoid worse evils when one was short of money, as the sum advanced was advanced to a person in urgent need, so such a poor and needy person would only require a little money until the emergency was over. The *Monte di Pietà* held a banking role for advancing petty cash or micro-credit and its more important rules dictated its transactions within certain parameters. These were scrupulously followed to ensure that the aims of the institution were strictly followed. Its *raison d'être* is safeguarded by the laws and rules governing its transactions to this very day.

The *Monte di Pietà* in Malta was founded in 1597 by *Commendatore Fra Manuel Couros* or *Quiros* of the Priory of Portugal who, 'moved by religious and Christian piety'¹ petitioned the Grandmaster Martino Garzes to set up this institution.² Initially, the *Monte* in Malta was not successful and it was the commitment of Grandmaster Perellos and the insistence of the Holy See that brought about the foundation of this lending institution as an instrument to combat usury. Though the first hundred years of its workings in Malta are not well recorded, the records of the pawnshop between 1700-04,

¹ NLM Libro 404 'Fondazione del Monte di Pietà sotto titolo di S. Anna' (French and Italian versions), 50-9; Fondazione del Monte di Pietà per Decreto del Capitolo Generale Celebrato nell'anno 1597 an Incarnazione ed in seguito ad un Ricorso avanzato a tale effetto dal Cavaliere Fra Emmanuele de Couros, Portuguese, 71-3.

² 'Tajjeb li Tkun Taf', in *Central Office of Information Review* (Henceforth COI) Jan. 1957, 1/57 & 2nd Feb. 1957; NAM, GMR 478, R. Micallef, 'Origin and Progress of the Government Charitable Institutions in Malta and Gozo' in *Malta Archaeological and Scientific Society*, 20th Apr. 1901, 10-13; Rossi, 2-33.

prove that the institution had established itself in a credit market flawed by illegality.³ Usurers often found loopholes by which they could make profits at the *Monte's* expense by trading around pledges presented at the *Monte* by their poor victims.⁴

The Monte under different rulers:

The setting up of the *Monte di Pietà* was part of the reworking of the *raison d'être* of the Hospitaller Order in post-Tridentine Europe.⁵ Through acts of charity the Order justified its position and tenure and built up a paternal relationship between the rulers and ruled. Charity also gave its providers an instrument of social control between the uppermost and lowermost classes and gave political legitimacy to the rulers.⁶ The same notion would apply for the period under British rule and the British realised this quite early in their relationship with the Maltese Islands. At the time of the arrival of the French, the *Monte di Pietà* was flourishing with valuable pledges and money to the amount of 420,000 scudi.⁷ This was annihilated by the French troops to finance Napoleon's Egyptian campaign and the *Monte* collapsed. Its resource of landed property could not, and had not been touched and, therefore, there remained some substance to rebuild on when it restarted operating after September 1800. The French also issued unfair and

³ Dalli, 'Beyond Charity: The Evolution of Credit as Charity in Malta 1400-1800', conference paper 'The bank of the Poor. The Credit upon Pledge and the Monte di Pietà in the Mediterranean (XVth to XIXth Centuries)', Naples, September 2004, 26-7.

⁴ Ibid., 26-7.

⁵ Ibid., 22.

⁶ Ibid., 24.

⁷ NAM GMR478, R. Micallef, 'Origin', 11; *The Democrat*, Saturday, 19th Jan., 1985,9, states that it was 443,484; A., V., Laferla, *British Malta vol.1 (1800-1872)*, Malta, 1938. Laferla states that it was 400,000; *Malta Government Gazette* (henceforth MGG), Supp., 7th Jan., 1948, part 1. In the Report of the Collector of Imposts and Lotto for the year 1946-47 it is stated that the amount was 280, 556 scudi.

equivocal regulations for the *Monte* which panicked the people into redeeming their pledges.⁸ On the arrival of the British, Sir Alexander Ball, and later Civil Commissioners and Governors implemented various paternalistic measures to sustain the *Monte* during British rule. This move brought two disadvantages: firstly, turning the charities into government departments meant the loss of voluntary contributions and secondly, as a result, the Maltese came to see the upkeep of the charities as the responsibility of the government.⁹

Even though the local government was repeatedly instructed to suppress departments and offices including the *Monte di Pietà*, things mostly continued as before. Due to the wider political context, between 1933 and 1940, the British deliberately extended the paternal system it had judged opportune to restore at the beginning of its rule. Arguably there was continuity over change in public administration and hence also in the running of the *Monte di Pietà*.¹⁰

The Case for Gozo:

Though in Malta the *Monte di Pietà* had served its clients since the time of the Knights, there is no record of a branch or any other form of counterpart in Gozo. The first *Monte di Pietà* in Gozo was founded on 5th August, 1805 by a decree issued by Sir Alexander Ball in response to a petition by Filippo Castagna, then Governor of Gozo.¹¹ Castagna was a Maltese who had organised resistance and fought against the French.¹² In the proclamation it is stated

⁸ C. Testa, *The French in Malta 1798-1800*, Malta, 1997, 238-337. (For a detailed account of the French administration of the *Monte di Pietà*).

⁹ Pirotta, *The Maltese Public Service 1800-1940 – The Administrative Politics of a Micro-State*, Mireva, Malta, 1996.

¹⁰ Pirotta, 426.

¹¹ NAM PS01,1804-08, 2, 122-4.

¹² W. L. Zammit, *Il-Mexxejja Maltin tal-Kungress Malti – 1799-1800*, (Malta, 1999), 29-33.

that since poverty has always been '*our concern*'-'*nostre più particolari premure*', the request for the opening of the *Monte* in Gozo was being accepted.¹³ This was in response to Castagna's petition of 12th February of the same year where he had given the reasons for his request: these mainly being the difficulty of crossing over to Malta and the inhabitants' eagerness for such an institution.¹⁴ The Gozitans agreed to forfeit the prize money of 3,000 scudi from the proceeds of the French surrender.¹⁵ The Gozitan initiative was acknowledged in the Order which set a parallel but separate Gozo *Monte*. The initial prize money was added to by the *Università* and by the Malta *Monte* which in 1817 gave it 8,000 scudi.¹⁶ There are nine regulations in the Order that structure the Gozo *Monte* on the same lines as the Maltese one.¹⁷ There were to be appointed three commissioners, one of whom was the First Jurat of the *Università* of Gozo, a second was one of the Judges of the Gozo Court and the third was the *Economo* of the Gozo Hospital. The Governor was not on the board, but he had a right to be present at their meetings. The *Monte* was to report annually to the Governor and the *Giurati* of Gozo, and it was to be run on the same lines as the Malta *Monte* with the same rates of interest. At that time pawns were to be kept for not more than one year.¹⁸ The pawns that could be received were gold and silver jewellery, '*cotone di natura o filato, e tele*': raw cotton, cotton yarn or woven cotton and other products of cotton, linen,

¹³ NAM PS01, 1804-08, 2, 122-4; 'Erezione del Monte di Pietà' nell' Isola di Gozo 1805' in *Raccolta di Varie Cose Antiche e Moderne Utili ed Interessanti Riguardanti Malta e Gozo*, (Malta 1843), 126-7.

¹⁴ Ibid.

¹⁵ Ibid.

¹⁶ A.M. Galea, L-Istituti tal-Carità f'Malta u Ghaudex, (Malta 1912), 25.

¹⁷ NAM PS01,1804-08, 2, 122-4.

¹⁸ Ibid.; 'Erezione', 126-7.

wool and silk that had not been used. The pay of the head clerk was to be 90 scudi annually and that of his assistant 45 scudi.¹⁹

The *Monte di Pietà* of Gozo was opened on 2nd January, 1806 at the premises of the then Gozo Hospital in St. Francis Square, Victoria. On 1st February 1841, the Gozo *Monte* lost its autonomy and became a branch of the Malta *Monte*.²⁰ This amalgamation was ordered by the Governor in a letter dated 28th January, 1841, wherein he requested the Commissary of the Malta *Monte* to submit measures that should be adopted for managing the Gozo branch.²¹ In a subsequent letter dated 3rd May, 1842 the Governor approved the appointment of the administrative staff which was to include the following:²²

Table 1

Salary	
<i>Deputy Commissary and Accountant</i>	£25.00.0 p.a.
<i>Clerk</i>	£25.00.0 p.a.
<i>Keeper of Pawns (to give security of £40)</i>	£25.00.0 p.a.
<i>Appraiser (to give security of £20)</i>	£15.00.0 p.a.
Two persons for night watch at £5 each	£10.00.0 p.a.

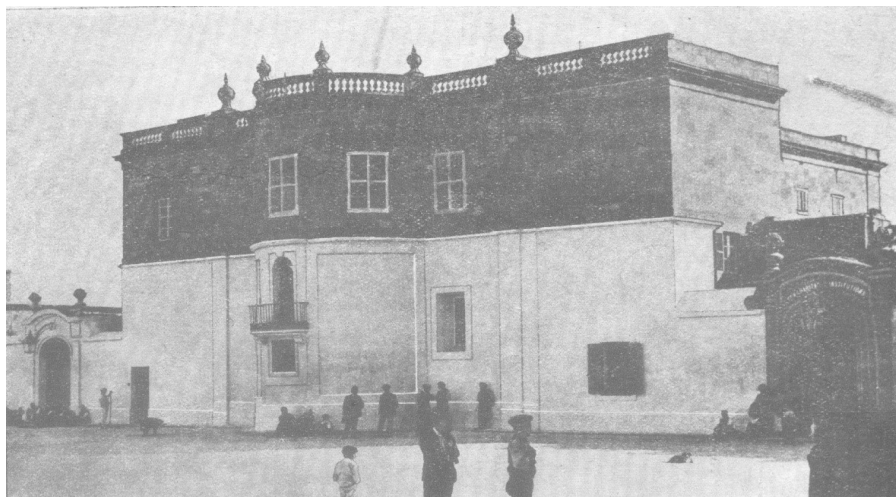
¹⁹ Ibid.

²⁰ Galea, 25.

²¹ NAM Libro 53 *Duplicato dei Conti per l'Anno 1841*. Letter dated 28th Jan., 1841 (No folio number).

²² Ibid.

Figure 1 - The old Gozo Hospital (originally known as St. John the Baptist Hospital), in St. Francis Square where the Gozo Monte di Pietà was first housed. c. 1930.



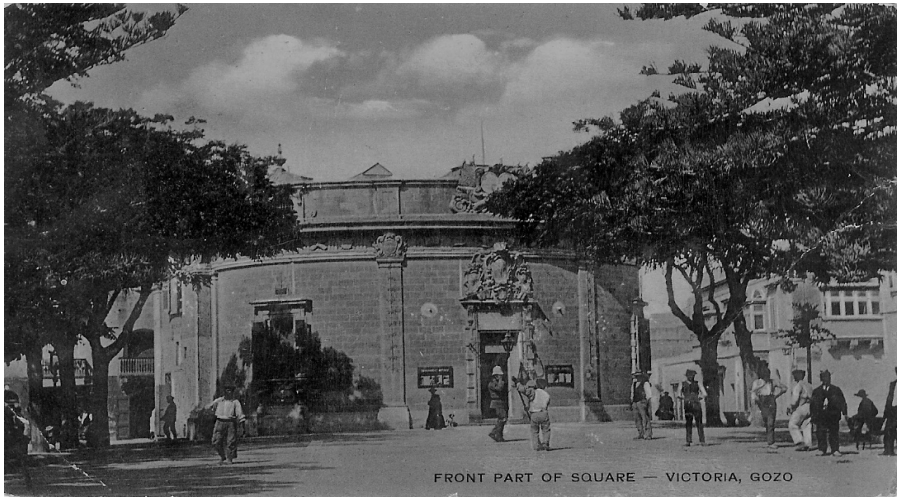
Source: J. E. Gatt, *A Guide to Gozo*, (Malta 1937).

Figure 2 - Entrance to the Old Gozo Hospital in St. Francis Square.



Source: 2009, photo taken by the author.

Figure 3 - The façade of the Banca Giuratale in it-Tokk Square (known today also as Independence Square), the second seat of the Monte di Pietà in Gozo.



Source: Old postcard courtesy of Dr. Michael Refalo.

Later, in 1884, it was transferred to the *Banca Giuratale* at *it-Tokk* Square, (today Independence Square), also in Victoria.²³ Initially there was opposition to this move through a petition signed by the Dean and Chapter of the Cathedral and bearing 116 signatures and 187 marks being sent to the Lieutenant Governor. The petitioners pleaded that the *Monte* might not be transferred from its then present locality. They objected because they wanted to save poor people from the shame of going to the *Monte* in an exposed place. This objection was settled by the fact that the whole business of the *Gozo Monte* at the time was transacted by four individuals who acted as agents. Moreover, it was also argued that the locality where the *Monte* was to be placed served the Police Office, the Receiver General's Office, the Office of the Charitable Institutions and the Office of Public Works and therefore one should not fear that any

²³ Galea, 25.

onlooker would guess which services they were engaging in. On being informed, the Dean and Chapter replied that after having learnt the grounds on which the Government thought proper to order the transfer, they no longer had any objection.²⁴ Later, it was moved across the street to the then Department of Commissioner of Inland Revenue after World War II, when the *Monte* in the Maltese Islands became part of this department.²⁵

Figure 4 - The then Department of Inland Revenue, (today Citadel Cinema), which was the last building where the Monte di Pietà of Gozo was housed. To the left of the photo there is the building of the Banca Giuratale which housed the Monte before.



Source: 2009, photo by author. No surviving old photos of this place could be located.

²⁴ *Debates of the Council of Government of Malta*, (henceforth *DCGM*), 1883-4-5, VII, 1-37, 3rd December 1884, 397-8.

²⁵ MGG 24th Aug., 1948, Notice 498, (Notice issued on 21st Aug., 1948, with effect 23/08/1948 revoking Notice 470 of 1937), 1096.

Gozo was under the administration of a civil servant appointed by the Governor. The title changed from Governor for Gozo in the early nineteenth century to Assistant Secretary to Government for Gozo to Commissioner for Gozo in the twentieth century. A Proclamation on 15th October 1815 removed the post of Governor for Gozo and put the Commander of Troops in Gozo as the Principal Civil Authority or Chief Civil Officer in Gozo. After Castagna's retirement, the Office of Governor was removed, and Archibald Dalziel became Collector of H.M.'s Land Revenue.²⁶ The Proclamation of 1st April 1823 revoked the post of the Commander of Troops in Gozo as the Principal Civil Authority or Chief Civil Officer in Gozo and put the Lieutenant Governor for Gozo instead.²⁷ In 1838, Major Bayley occupying this latter office became Inspector of Executive Police for Gozo and Comino and the highest civil authority in Gozo.²⁸ Then in 1885 the office was again removed for Assistant Secretary to Government for Gozo.²⁹ The office of Assistant Secretary to Government for Gozo, was revoked by the Government Notice of 2nd June 1922 and became Commissioner for Gozo.³⁰

Gozo was and still is to a good extent dependent on Malta. All vessels bound for Gozo had to report at the Port of Valletta to pay customs duty and get permission from the Health Office. This was compulsory for all outward bound vessels. Before the British arrived, Gozo had its own Court of Justice and its own *Università*.³¹ The latter had municipal responsibilities parallel to those of the one in Malta. In Malta, Maltese employees in courts and charities retained some

²⁶ *Gazzetta del Governo di Malta* (Henceforth GGM), 19th October, 1814, 207.

²⁷ MGG 8th April, 1823, 3461.

²⁸ MGG 26th March, 1838, 117.

²⁹ MGG 1st Sept., 1885, 314-5.

³⁰ MGG 7th June, 1922, 327, Government Notice of 2nd June, 1922. The Assistant Secretary for Gozo became the Commissioner for Gozo.

³¹ Staines, 91.

nominal authority but 'in every case they were either subordinated to a British head such as the Chief Justice or outnumbered by British members on the Board.'³² There was however, in Malta a symbiotic alliance between the British Imperial authorities and the local elites.³³ In doubly insular Gozo, the Governor was either Maltese or British and so were most of the top ranking civil servants.³⁴ Only most of the lesser employees in a comparatively small civil establishment were Gozitan and hence the cycle of poverty was perpetuated in Gozo.³⁵

Due to the limited area of the main Gozo town, namely Victoria or Rabat, the various government departments in Gozo have always been in close proximity to each other. Though they were moved around at different times in their history, the two places they mainly occupied were the premises of the *Banca Giuratale* in *it-Tokk* Square, (today Independence Square), still called *it-Tokk* by the locals and St. Francis Square, the site of the first ever hospital in Gozo. In fact, today all government offices together with the Ministry for Gozo are clustered there. It is as if things have come full circle as this site was the first site ever where government offices had seat, excepting the *Banca Giuratale* where the *Università* had always had its seat.

It seems that as the *Monte di Pietà* of Gozo proceeded into the next century and especially during the 1920s and 30s its functions were reduced as was its staff. In 1913 there was a Keeper of Pledges,

³² Pirotta, 100.

³³ Chircop, 'Brokers, Collectors, Collaborators: Mediating Colonial Modernization in Malta 1870-1914' (43-56) in *Proceedings of History Week 2003*, Malta Historical Society, (Malta, 2005), 42-56.

³⁴ NAG ST2/63-83, Blue Books for relevant years, the surnames indicate this fact; F., Masini, 'The Governance of Gozo, 49. An outline of how Gozo was governed from remote antiquity to modern times' in M., Cauchi (ed.) *Gozo Past and Present*, Gozo, 2002; C., Cassar, 'Everyday', 120.

³⁵ *DCCGM 1880-1*, Sitting no.17, 539.

Felice Attard appointed on 13th August, 1895 who was paid £60.00.0 annually and an Appraiser of Pledges, Alexander Fenech, receiving the salary of £50.00.0 annually.³⁶ In 1923, Felice Attard still occupied the same position but his salary had been raised to £100 and there was a new Appraiser of Pledges, George Meilak, appointed on 16th January, 1918, receiving an annual salary of £90.³⁷ Then, in 1933 there were Giuseppe Vella Muscat as Keeper of Pledges and Giuseppe Meilak as Appraiser of Pledges. The latter was the former appraiser's son.³⁸ Vella Muscat had been appointed on 12th April 1932 and was being paid an annual salary of £100.00.0 while Meilak had been appointed on the 29th December, 1925 and was being paid £90.00.0 annually. This was much less than their counterparts in Malta who were paid £210.00.0 and £140.00.0 respectively.³⁹ Though the Maltese employees had been appointed before the Gozitans, it was traditional that Gozitan employees received less pay on account that life on Gozo was considered cheaper.⁴⁰ Besides, as mentioned earlier, lesser ranking posts were always occupied by Gozitans as it was the highest ranking posts that the Maltese and British occupied. Another reason for this state of affairs is that Gozitans were so poor and lacking in education that it was hard to find competent employees.⁴¹

³⁶ NAG Blue Books 1913, 58.

³⁷ NAG Blue Books 1923, 58.

³⁸ This I have realised since he sometimes redeemed on behalf of others as did other members of his family (all share the same family nickname *tas-Sabiħa* literally 'of the beautiful one'[feminine]), but this will be discussed in detail in the case studies in another article.

³⁹ NAG Blue Books 1933, 58. In this case, however, the Keeper had been appointed on 12th September 1908 with a more recent appointment on 13th April, 1920 while the appraiser had been first appointed on 28th July, 1906, received another appointment on 18th October, 1921 and another one on 23rd August, 1926.

⁴⁰ *1912 Royal Commission Minutes of Evidence* (henceforth 1912RCME), 251-2.

⁴¹ *DCGM 1880-1*, Sitting no.17,539. A Maltese clerk was appointed at the Gozo Monte as a clerk 'of some ability and standing' could not be found in Gozo.

It must also be kept in mind that these employees had to provide a financial security or guarantee as their job entailed the handling of precious metals and jewels. An injustice that was performed against the *Monte* employees in the Maltese Islands was when, following the Clauson Report, their pension was withdrawn. Due to the gravity of their responsibilities, they were, after consideration by a Commission appointed for their specific case, put again on the pensionable employees list.⁴² The Malta *Monte* had nine employees in all.⁴³ The employees in Malta were described as Keeper and Appraiser of Gold & Silver articles while those in Gozo were not. In Malta there was a Keeper and an Appraiser for Draperies but in Gozo there were no such posts.⁴⁴ The employees in Gozo were simply either Keeper or Appraiser of Pledges meaning that the Gozitans either appraised other articles such as draperies as well or that people no longer pawned draperies or perhaps that such articles were not accepted anymore.⁴⁵ It also means that the other duties of clerk and cashier were either carried out by them too or else the services of such employees was done by civil servants who had other duties but were shared within the government departments as the *Monte* was physically part of a larger complex of government departments.⁴⁶ There was a messenger at the Gozo branch earlier on as in previous records of expenses there is often an entry for this messenger's uniform. However, the expenditure of the *Monte* too was in decline as it started with a total of £13.18.6 in 1909-10 and went

⁴² *Parliamentary Debates – Official Report of the Debates of the Senate of Malta*. 1924-7, 6,3,3178-9. (Sitting of 18th May, 1927)

⁴³ NAG Blue Books 1933, 58.

⁴⁴ NAG Blue Books 1933, 58.

⁴⁵ There is no record of what kind of objects were pawned in the Blue Books or Departmental Reports. There are only tickets having to do with gold articles but there is a number of missing tickets for this decade.

⁴⁶ As discussed, in Gozo, the government departments were either all in the same building or in extremely close proximity.

down to £2.06.0 in 1916-17 up to £5.14.10 in 1919-20.⁴⁷ The services of a messenger may also have been shared intra-departmentally.

Rules and Regulations:

The *Monte di Pietà*, like other government departments, was strictly administered by higher ranking personnel such as the Keeper and the Appraiser. These gave a guarantee in money, and everyone carried out their duties as dictated by the regulations. Most of the statutes of the *Monti* all over Catholic Europe provided for the full and personal liability of the personnel charged with estimating the pledges. This meant that after expiration of the loan-term, if unredeemed pledges were sold at auction for less than the estimated price, the estimators were liable for the loss. Such provisions kept personnel from squandering their capital.⁴⁸ Care was also taken by those at the top in Malta for occasional changes of officers, 'especially in Gozo'⁴⁹ since things there were further out of reach for the administrators in Malta. On such occasions, when there was a change of officer, a survey was taken, books were examined, an inspection of all registers and money books was made. Furthermore, the successor would be most careful to see what he received from the outgoing officer. Such changes would provide a security that everything was correct and that every personal responsibility had been shouldered.⁵⁰ This kept civil servants on their toes.

⁴⁷ NAG Blue Books 1909-10 to 1919-1920, W5 or W6.

⁴⁸ L. Fontaine, 'Women's Economic Spheres & Credit in Pre-Industrial Europe' in Beverly Lemire, Ruth Pearson & Gail Cambell (eds.) *Women and Credit. Researching the Past, Refiguring the Future*, (Oxford, 2001), 12.

⁴⁹ *Debates of the Council of Government of Malta*, 1880-1, V, 1-20, 17, Friday 6th May, 1881, 539.

⁵⁰ Ibid.

The regulations of the *Monte*, amongst other things, outlined in detail the duties of the staff. The Officer in Charge had the duty of supervising the staff and of ascertaining that the pawns were kept safely and well-ventilated to prevent any possible damage especially for clothes by way of mould and other such harm. He was also expected to inspect the pledging books. The cashier was responsible for all computations of interest and for keeping the various accounts concerned with the maintenance of the institution. Every statement had to be signed by the Officer in Charge. The technical staff was concerned principally with the valuing and custody of the pledges. They were required to keep duplicate and separate records of the daily transactions for reconciling their registers daily with the main cash register kept by the cashier.⁵¹ Work was carried out in a meticulous manner as money was involved and employees considered themselves privileged to hold a government job, but this does not mean that there was no humorous interaction at all.⁵²

When it came to redemption, it seems that the clerk or employees in Gozo were lenient in that they let other people, mainly relatives, redeem as long as they produced the relevant ticket. Administrative flexibility inherent with the application of the regulations seems to have been of fundamental importance for such an organisation as the *Monte*.⁵³ The fact that often relatives, agents⁵⁴ and neighbours collected on behalf of clients is not discussed in this article but will be discussed in a possible future one. Therefore, the atmosphere seems to have been one

⁵¹ NAM Libro 78, *Libro delle Deliberazioni dal 2 Maggio, 1835 al 30 Dic., 1837*, 165-214, Reg. 23.

⁵² A. Zammit, 'The Changing Face of Gozo', in M. N. Cauchi (ed.), *Gozo Past and Present*, (Gozo 2002), 23-32.

⁵³ Camilleri, 29.

⁵⁴ *Debates of the Council of Government of Malta*, 1883-4-5, VII, 1-37, 3rd December 1884, 397-8.

of seriousness when carrying out their duties punctuated by concessions of the practical kind and by the dry humour Gozitans are usually used to.⁵⁵ Obviously, all employees were male which means that this institution was both paternalistic and patriarchal in structure. It was one of the few occasions when women had to deal with men on a brisk, businesslike manner, even often try to haggle to get their valuables assessed for the best possible price. The way gold and silver jewellery items were assessed for pawning will be discussed further down when discussing the actual procedures of pawning and redeeming.

The *Monte* regulations were tailored to help it reach its social and charitable intentions. The first regulations were included in the deed of foundation and more detailed ones were then drafted in 1720 by Grandmaster Zondadori. The philanthropic aspect was again emphasised and the maximum that could be advanced on a single pledge was fixed at 15 scudi as it was deemed that *'the poor did not need a sum above that amount.'*⁵⁶ After the re-

⁵⁵ A. Zammit, 'The Changing Face of Gozo', in M. N. Cauchi (ed.), *Gozo Past and Present*, (Gozo 2002), 23-32. The following anecdote (by the above author) clearly depicts the Gozitan dry humour people living on such an island and having to battle with so many problems and drawbacks on a daily basis, possess. During World War II, two messengers worked in the Commissioner's Office which included the *Monte di Pietà* on top were the pawned valuables were kept. The older messenger, Ġużepp (Joseph), was the relaxed type and he was also the custodian, so that his duties included sleeping on the premises at night to guard the valuables pawned. Whenever he felt that others were ordering him around, he used to say, 'Here I am paid to sleep.' The younger messenger, Ċikku (Francis), was active and restless and he practically ran the office. One of the jobs he took upon himself was the preparation of the weekly pay packets. Once, there was a cost-of-living bonus. Ġużepp, who though he was lazy, was conscientious, went up to the head of department and said, 'I only want what is mine, there is more in the envelope!' to which Ċikku, who was writing at the other end of the room, lifted his head and answered, 'Perhaps you slept a bit more this week, Ġuż.'

⁵⁶ NLM AOJ 6405/7, 87-97 & 33-38. NLM Libro 404 - new and revised administrative regulations were issued again in 1787 under Grandmaster de Rohan, 107-117.

establishment of the *Monte* under British Rule, new regulations were drafted in accordance with the then existing state of the *Monte*. The Commissary was enlarged, and the rate of interest was raised. More detailed regulations were then read and approved during a sitting of the Congregation of the *Monte* on 24th September, 1836 and these served as the basis till the 1970s when amendments to existing regulations were issued.⁵⁷ The salient and most important points these regulations established were the security amount in scudi, and later pounds sterling, the technical staff had to give, and also rules of procedure in connection with the running of the office for Gold and Silversmiths.⁵⁸

The regulations in *vigour* at the time of concern for the scope of this article had been issued when the *Monte* was under the guidance of the Comptroller of Charitable Institutions.⁵⁹ They had basically retained the original regulations with minor amendments concerning security money, interest rates and other amendments necessary due to new coinage and other minor things having to do with changing practices and times. They specified the administrative staff at the *Monte*, set new rules to be observed in the daily transactions of pawning and redeeming, revised the security which had to be given by those responsible for the management of the *Monte* and the custody which invariably had to be observed in the safekeeping of the pledges. These regulations were not contemplated and issued in virtue of any enabling Act, meaning that they were void of legal force. They were simply administrative measures set out with a view to ensure the smooth running of the

⁵⁷ NAM Libro 78, 166.

⁵⁸ *Ibid.*

⁵⁹ MGG *Suppl.*, LVI, 18th November, 1921. *Charitable Institutions - Report by a Committee appointed by order of His Excellency Field Marshal Lord Plumer, G.C.B., G.C.M.G., G.C.V.O. Colonel York and Lancaster Regiment, Governor and Commander-in-Chief, Malta, October, 1921.*

Monte. Therefore, there were no rights or obligations attached. Rights and obligations having to do with loans made by the *Monte* with the security of pledges arose from the Civil Code and from the conditions laid down in the pawn ticket, which were of a contractual nature.⁶⁰ The most important of these was that the articles pawned had to be redeemed within the specified timescale, otherwise they would be sold by Public Auction. Any surplus that might have remained would be paid to the client bearing the ticket.

The *Monte* would be open all days except Sundays and public holidays. Dealings with the public would be carried out in the mornings while the afternoons were kept for the necessary scrutiny and paperwork. The public would be able to pawn and redeem till eleven o'clock in the morning even though the official hours were from 7.30 a.m. till noon.⁶¹ Evaluation of pawns would commence at 7.30 a.m.⁶² The summer opening hours from 1st July to 30th September were from 8.00 a.m. till 1.30 p.m. while the winter ones were from 8.00 a.m. to 4.00 p.m. The extra time needed was for the officials to finish their work as pawning was a process. Pawning essentially entailed the pledging of draperies or jewellery items in return for a set fraction of their worth. The pledge had to be presented by an adult and the minimum advance on any pledge was that of six pence.⁶³ The personnel would always be on the alert against the use of the *Monte* money for speculation purposes since albeit specific regulations against this practice, the possibility remained.⁶⁴ Advances of money were determined by the quality of the articles presented at the *Monte*. On gold and silver jewellery, brass and

⁶⁰ Memo by Dr. V. Gatt re Reg., 33 in Camilleri, 32.

⁶¹ *C.O.I. Review*, 2nd February 1957, 7; *Guida*, 1937,152.

⁶² *Guida Generale Malta e Gozo/General Guide Malta and Gozo, 1914,124;1925,138; 1933-4,151.*

⁶³ NAM Libro 78, 165-214, Regulation 17.

⁶⁴ Camilleri, 30.

bronze and on draperies of linen and cotton, and on woollens, the money advanced was equal to three-fifths ($\frac{3}{5}$) of their estimated value, whilst on diamonds and pearls, the advance amounted to one half ($\frac{1}{2}$). There was also a maximum fixed amount which changed according to the times, but which served as prevention of any form of speculation and to keep the *Monte* close to its original purpose.

Various other regulations existed and still exist to ensure the safe custody of the pawns. For example, Regulation 23 provides instructions on how the tickets should be completed and how they must be checked and filed. The following regulation imposes on the Keeper the responsibility for the safekeeping of the pledges and the next regulation goes on to specify that the pledges can only be inspected on an order from the Officer in Charge. In Regulation 45 one finds the detailed check which must be carried out in the event of the appointment of a new Keeper.⁶⁵ The Regulations about pawning give details of how pledges should be valued and stored. After valuing, the pledges were to be placed in the same order as they were received by the Keeper. Then he would read out the ticket of valuation attached to each pledge and ascertain the existence of the articles specified in it as well as the name of the client and note in his book its number and the amount advanced. In the meantime, one of the clerks had to enter all the particulars in the register of pledges and another proceeded to fill the ticket, bearing the number and date of the pledge, the name of the client, the detailed enumeration of the objects of which it consisted, in the mode in which it had been presented, and how it was to be kept – whether in a small box, wrapper or bundle.⁶⁶ In many of the tickets where draperies were pawned a cloth wrapper, mostly cotton, would be included in the list of pawned goods as these

⁶⁵ NAM Libro 78, 165-214.

⁶⁶ *Ibid.*

would be presented in such a wrapper.⁶⁷ After the above procedure, the tickets would be compared with the entry in the registers of pledges and transferred to the senior clerk, who after adding up the various amounts and comparing the same with the amounts and numbers thereof noted in the book of the Keeper, would issue the respective advances to the client. This long process shows why pawning and redeeming stopped at eleven so that both officers and clients would be finished by twelve.⁶⁸

Articles could also be pledged at the Monte for the specific purpose of safe custody. Up to 1915 this was the practice. Since this facility favoured the well-to-do rather than those in need, it defeated Regulation 46 which specified that '*no deposit of valuable articles, money or other objects is to be received at the Monte for safe custody*'.⁶⁹ This system was discontinued after a Government Notice was issued on 4th October 1915 which strictly prohibited the practice.⁷⁰

All advances of money were made for the specific periods within which the articles had to be redeemed. The actual time periods for each type of pawn will be specified below where pawning will be discussed from the clients' point of view, so, for the sake of avoidance of repetition it will be left out here. The interest at the time of concern for this article was first 5% and towards the end of the period (1938), it was reduced to 3%.⁷¹ This reduction seems to have been affected following the indignation of the general public at the interest rate

⁶⁷ Pawning tickets researched from 1910-1914. These are the only tickets which feature draperies as pawned goods.

⁶⁸ C.O.I Review, 2nd Feb. 1957, 7.

⁶⁹ NAM Libro 78, 165-214, Regulation 46.

⁷⁰ MGG 4th October 1915, *Government Notice Number 215 of 1915*.

⁷¹ The rate had been reduced from 6 to 5% on 22nd August 1838 by a Government Notice and to 3% in 1938 by another Government Notice – MGG 1st April, 1938.

of 5% which at that time was considered little short of usury on the part of the Government. In a letter to the *Times of Malta*, the individual in question criticised the Government as usurious and said, 'if something is not done, our "Mount of Mercy" will soon be known as the most unmerciful institution in the world.'⁷²

Other criticism levelled at the *Monte* can be found in several issues of '*Il Mediterraneo*' during the nineteenth century.⁷³ Being a pro-Italian paper, it criticised both the intra-departmental and the British Governor's administration. One of the article writers resents the fact that an establishment which grew up entirely from private charities, over which '*the civil government had no right to assert the slightest control; but of the administration of which that government, nevertheless, despoiled the people.*'⁷⁴ Besides being anti-British, the newspaper was also pro-middle class, and this bias barely masked by superficial concern for the lower classes. The same article goes on to criticise the 'high' 5% interest rate and the low proportion of amount advanced compared to other countries. It then devotes a substantial part to the procedure of sale by auction. It calls it a monopoly and it says that the sale used to be carried out in a small room on the premises where it was '*not likely that any respectable individuals would be induced to repair.*' Then, '*by a mockery of publicity*' the sale started taking place at the door of the building where '*indeed any but the lower classes would feel disposed to form part of a mob, in attending a street sale...*' It then goes on to outline the right procedure for a proper auction.⁷⁵ In another article the fact that not more than two pawns could be redeemed at any one time is criticised since there were agents acting on behalf of others

⁷² *Times of Malta*, 31st July 1935.

⁷³ *Il Mediterraneo*, No. 687,689, 725 & 727.

⁷⁴ *Il Mediterraneo*, 16 June, 1852.

⁷⁵ *Ibid.*

and that needy people who pawned often had to redeem several pledges quickly due to emergencies. Here again the departmental and governmental administration is criticised.⁷⁶

To redeem, the client needed the relative pawning ticket which was then kept by the clerk in charge. At the back he noted the name, nickname and town/village of provenance of the redeemer together with the date of redemption and the amount paid on redemption. If the ticket was lost or mislaid, the proprietor would be allowed to withdraw the pledge/s on giving a security approved of by the Keeper; a procedure which will be explained in more detail below when discussing redemption from the clients' perspective.

If the articles were not redeemed within the prescribed time, they would be sold by auction. Under Section 2074 of Ordinance No. VII of 1868,⁷⁷ the *Monte* was empowered to sell all unredeemed pledges without the need to obtain judicial authorisation. Pledges advertised for sale on the Government Gazette could be renewed by their proprietors until the afternoon of the day before the actual sale. From the proceeds of the sale the *Monte* would collect the capital advanced and the interest due. After the settling of any other expenses incurred, any resulting surplus could be claimed and recovered by the owners of the pledges sold. Many clients were not aware of this provision and their surplus remained unclaimed.⁷⁸ There was no provision for this event in the Regulations except claims by prescription and hence this constituted a liability on the institution as surpluses could not be included in the actual capital of the *Monte*.⁷⁹

⁷⁶ *Il Mediterraneo*, 23 June, 1852.

⁷⁷ *The Civil Code* Chapter 23.

⁷⁸ This fact was advertised in two identical articles published at different times in the *C.O.I. Review* – 2 Feb., 1957,7 & Jan. 1957, No. 1/57; Camilleri, 35.

⁷⁹ NAM Libro 78, 165-214, Regulation 46.

Pawning and redeeming from below - the client's side:

The above gives a view of pawning from the official side; from the clients' point of view there were other observances and processes one had to go through. The jewellery presented for pawning would be assessed on the value of the precious metal/s and not on craftsmanship. The value given would be based on the government's set value for gold which was often a low one.⁸⁰ After it was assessed, the client would be given a piece of lead with a number on it by the appraiser and she would have to wait until the cashier called her. Then the estimated amount would be advanced, and the ticket would be handed over to her. If the amount superseded £2, a penny stamp duty was due.⁸¹

The *Monte* also offered the possibility of assessing the value of gold, silver and precious stones against a fee. Sometimes clients went in to get their pledges valued by the Consul and then asked a private lender to give them more. At times, the private lender himself would ask them to do the above and promise to advance more. In this case the clients saw the short-term benefits and often grabbed such an opportunity. Another shortcoming of the *Monte*, though indirect was the fact that the Governor set the price of gold and silver according to the Malta weight and in sterling. The Jewellers Ordinance of 1920 had laid down a fixed rate calculated on the gold standard pound sterling basis. With the abandonment of the gold standard the value of gold was continually fluctuating and consequently the Government Valuer was actually undervaluing gold articles manufactured in Malta. Goldsmiths, therefore, preferred selling the gold for export to selling to local jewellers.⁸²

⁸⁰ Unnumbered Ordinance of 1937. *Ordinance No. of 1937*, in *Ordinances Book*, 1510-1.

⁸¹ *DCGM 1900-01*, vol., XXV, Sitting no. 27, Wed., 24th April, 1901, 899-900.

⁸² Unnumbered Ordinance of 1937. *Ordinance No. of 1937*, in *Ordinances Book*, 1510-1.

Prospective clients of the *Monte* preferred pawning privately. At times goldsmiths resorted to melting gold coin to make gold items which then would obviously bring in more profit.⁸³

The clients were strongly advised to keep the ticket in a secure place since losing it was tantamount to losing the gold itself. In such an event one would have to file a note of sequestration at the *Monte* so that if the ticket would be found by someone else, this latter could not redeem it. The pawn would then be given to its rightful owner only after the expiration of three years and on condition that the client would provide a guarantor who would promise to advance the same sum of money to anyone else who claimed rights over the same piece of jewellery.⁸⁴

When it came to redeeming, the clients had a fixed time period - three years in the case of jewellery, two when it came to cotton, linen and silk draperies and clothes, brass and bronze, and six months in the case of woollen draperies and clothes.⁸⁵ This period of time could be renewed if the interest and the difference between the value of the pledge when pawned and its value at the time of the renewal were paid. In the event of the failure of a renewal, the pawn would be sold according to the official procedure described above and the client would get the surplus profit if she knew that this rule existed and if she applied for it.⁸⁶

In 1921, a report on the state of the Charitable Institutions in the Maltese Islands was undertaken.⁸⁷ Its main aim was:

⁸³ NAM MDP 177.

⁸⁴ C.O.I Review, 2nd Feb. 1957, 7.

⁸⁵ Information found on actual pawning tickets and NAM Libro 78, 165-214; C.O.I Review, 2nd Feb., 1957, 7.

⁸⁶ This fact was advertised in two identical articles published at different times in the C.O.I. Review – 2nd Feb., 1957,7 & Jan. 1957, No. 1/57; Camilleri, 35.

⁸⁷ MGG *Suppl.*, LVI, 18th November 1921. *Charitable Institutions - Report by a Committee appointed by order of His Excellency Field Marshal Lord Plumer, G.C.B., G.C.M.G., G.C.V.O. Colonel York and Lancaster Regiment, Governor and Commander-in-Chief, Malta, October 1921.*

*to enquire into the various sums expended from the Revenue of the Island on Charitable Institutions, and to submit recommendations with regard to any changes which the Committee may consider desirable in the present organisation and administration of the public charities.*⁸⁸

The Committee further specified that it sought ways to decrease expenditure and increase revenue without being detrimental to the aim of the institutions themselves. It wanted to investigate *'the possibility of expansion or relief of Government Institutions by co-operation with private establishments.'* In other words, it wanted to re-introduce private benefactor and church involvement in charity to alleviate the burden on the Government. It confirmed the belief that *'a large number of individuals [were] in need of charitable assistance'* and that though there was a good amount of charitable activity, it was *'disjointed and haphazard and required organisation'*. It also set out to prepare a scheme for reorganisation of the *Monte* and the other institutions amongst other things.⁸⁹

It selected the *Monte* as an example of the difficulty of reconciling the financial with the charitable aspect. Even though it was considered the most philanthropic of all government charitable institutions and the only profit making one, the money made was not channelled into the *Monte* itself to further help its clients in, perhaps, new and different ways but it was used to help hospitals which were not charitable institutions at all but were government commitments by law. Furthermore, it was burdened with a debt contracted not through any shortcoming of the institution but

⁸⁸ Governor's Letter No.1331 of 6th April 1921.

⁸⁹ MGG *Suppl.*, LVI, 18th November 1921. *Charitable Institutions - Report by a Committee appointed by order of His Excellency Field Marshal Lord Plumer, G.C.B., G.C.M.G., G.C.V.O. Colonel York and Lancaster Regiment, Governor and Commander-in-Chief, Malta, October, 1921*, 2, II, III, 598, 601.

because of the French pillage over 120 years before. This amounted to £35,300 on 31st March 1921 and incurred an interest of 3¼ % annually. The Commission argued that the poorest classes were paying this interest on a debt '*which should have been wiped off generations ago or borne by the whole community.*'⁹⁰ Such was the state of affairs of the *Monte* so many years after the French disaster. This debt which had originally stood at £54,150 was extinguished in 1934.⁹¹ It strongly recommended that this debt be reduced to £15,000 which was the sum needed for the running of the *Monte* for one year. Its other two main recommendations were the re-organisation of the *Monte* by improvement of method and equipment and the application of profits to charitable purposes.⁹²

The report went on to specify steps to be taken when weighting, noting and storing pledges, bookkeeping and procedures during sales. It also defined surplus return regulations noted earlier in this chapter when discussing pawning and redeeming regulations, and proposed a new and efficient office layout all of which should cut costs and maximise efficiency.⁹³ It also proposed a new ticket size and layout all with the aim of achieving economy of personnel and an efficient service.⁹⁴ They raised the salary of the Keeper by ten pounds as they had increased his responsibilities and suggested that if possible his office should be placed on the Pensionable

⁹⁰ MGG *Suppl.*, LVI, 18th November, 1921. *Charitable Institutions - Report by a Committee appointed by order of His Excellency Field Marshal Lord Plumer, G.C.B., G.C.M.G., G.C.V.O. Colonel York and Lancaster Regiment, Governor and Commander-in-Chief, Malta, October, 1921*, 2, IV, 599.

⁹¹ NAM Treasury File 1838/34.

⁹² MGG *Suppl.*, LVI, 18th November, 1921. Appendix I, XIII, 609.

⁹³ *Ibid.* Appendix I, 7, XXIX, 625-6.

⁹⁴ *Ibid.* Appendix I, 7, XXX, 626. The actual layout of ticket was not adopted but two tickets were printed to the page having all odd numbers at the top and all even at the bottom for easy reference. In the 1930s, the date was typed on the ticket and not handwritten anymore.

Establishment. The Commission specified that the Memo was intended to replace the standing Regulations of the *Monte* as far as transactions were concerned but left the other regulations unaltered.⁹⁵

This is the last report for the period in question for this article, but another report drawn in 1948, besides giving a brief account of the history of the *Monte* and of the finances and workings for the previous year, states that business had dwindled considerably especially in Gozo where only thirty-three pawns had been pledged and thirty-two redeemed in the previous year. It attributes the decline in business to two main factors: '*restricted unemployment and the premium paid on the open market over and above the official value of gold as fixed by Government Notice No.640 of the 26th December, 1939.*'⁹⁶ It went on to say that the *Monte* based its valuing on this notice and as a result prospective clients were discouraged. This means that business had in fact been dwindling before the war broke out.⁹⁷

Conclusion:

This look at the *Monte* from its beginnings in Western Europe and its original scope to its particular story in Malta and especially in Gozo brings insight into the development of a charitable institution that was autonomous and that heralded the beginnings of modern banking. It offered petty credit to the deserving poor and introduced the idea of empowerment as opposed to that of abandonment

⁹⁵ Ibid.

⁹⁶ MGG Supp. I, 1948, XV.

⁹⁷ MGG Supp. I *Report of the Collector of Imposts and Lotto for the year 1946-7*. Mr. V. Gatt, Collector of Imposts & Lotto, who drew out the report, goes on to state that steps had already been taken by his Department for revising the Government Notice in question.

to fate. At the time that it was introduced in the Maltese Islands, credit was scarce and the credit system '*tied down landholdings as collateral.*'⁹⁸ The *Monte di Pietà* was also introduced amidst much usurious practices and it was some time before it became a fully-fledged institution.⁹⁹ It grew financially stronger when it was merged with the *Monte di Redenzione* and from then on it remained on a sound footing until the French deterred clients by first changing regulations such as those on interest rates and pledge time span and then pillaged the *Monte* at the end of their stay.

Then the British re-established it with difficulty and after giving guarantee of a safe investment to the people, the *Monte* was slowly but surely set on its feet once more. They, like the Knights Hospitallers, had understood its importance as a tool for social control. Its autonomous state was removed when Maitland assumed full responsibility of and therefore asserted control over the charitable institutions. Though at first this gave excellent results, it all came to an abrupt end when the grain monopoly was broken. The fact that the state took full responsibility of the charitable institutions meant that the people would expect a paternalistic stance from the government and that it had killed off all possibility of religious and private benefactors.¹⁰⁰ This was something the Report of 1921 tried to revive. It seems that things had come full circle and that the government was once again seeking the help of private benefactors to help with the charitable institutions.¹⁰¹ In Gozo, the *Monte* was incepted after petitioning

⁹⁸ Dalli, 1.

⁹⁹ Rossi, 33.

¹⁰⁰ Pirota, 100.

¹⁰¹ MGG *Suppl.*, LVI, 18th November 1921. *Charitable Institutions - Report by a Committee appointed by order of His Excellency Field Marshal Lord Plumer, G.C.B., G.C.M.G., G.C.V.O. Colonel York and Lancaster Regiment, Governor and Commander-in-Chief, Malta, October, 1921*, II, III, 598, 601.

by the inhabitants, who agreed to forfeit the prize money due as reparation for the French surrender to start this charitable institution.¹⁰² It developed slowly and took pawns in the form of draperies, clothes and brass and bronze and also of gold and silver jewellery, the latter being the most popular.

As an institution, the *Monte di Pietà* had its regulations tailor-made for its charitable purpose and to ensure a conscientious service to the needy. These regulations were modified or enhanced to make the institution both efficient when rendering service and to decrease expenditure as much as possible.¹⁰³ However, meticulous regulations were not enough. Though measures were taken for locally produced gold and silver to be up to standard, the price of gold as set by government notices was much less than that on the open market. Added to this, the rate of 5% interest was relatively high and it was only in 1938, after various complaints that it was brought down to 3%.¹⁰⁴ These two realities coupled with the insecurity of an oncoming war brought almost to a halt pawning in the Maltese Islands, and especially in Gozo.

¹⁰² NAM PS01,1804-08, 2, 122-4; 'Erezione', 126-7.

¹⁰³ MGG *Suppl.*, LVI, 18th November 1921. *Charitable Institutions - Report*, 598, 601.

¹⁰⁴ MGG 1st April 1938. The rate had been reduced from 6 to 5% on 22nd August 1838 by a Government Notice and to 3% in 1938 by another Government Notice.

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**Coming Home?
A Qualitative Study of Return
Migration to Gozo**

Ylenia Refalo

Abstract:

Return migration is a part of the migration's complex cycle. In part it is a continuing journey for an improved lifestyle and a movement by which emigration from the home country to a host country is followed by a return to the home country. This dissertation addresses Gozitan citizens who relocated to their ancestral homeland, and it explores the reasons for their relocation. It focuses on the transitory period upon arrival that respondents experienced and their aspect of 'duality'. Using qualitative research methodologies, semi-structured interviews were held in Gozo with 25 respondents (twelve women and thirteen men), who lived in Australia, the U.S. or Canada and returned home. The latter together with the case studies from other countries in Europe, attempt to provide an understanding into the multi-layered issues of return migration and emphasize the roles of transitions and duality. The findings reveal that the main reason for leaving Gozo was economical, as Gozo was experiencing serious unemployment. However, this move was not an easy one and in fact along their migration cycle, returnees experienced both enjoyable experiences and hardship. Coming face to face with different religious beliefs and new social norms, returnees were influenced and they had to adapt to these new social norms of the host country. During their stay in the host country, Gozitans frequented, clubs and associations formed by Gozitan and Maltese migrants where they could meet and interact with each other and exchange their everyday experiences and problems. Interacting with fellow Maltese and Gozitans enabled them to keep practising their mother culture and maintain their duality. As time went by migrants started to return back to Gozo due to social attachments and strong family ties. This process of return migration can be reflected in the many house name plaques and house façade stone decorations in the

island of Gozo. Participants were grateful to their host country for recovering them from the material deprivation of Gozo. As it is pointed out and suggested throughout the dissertation more support and recognition is being and should be given to these returned migrants.

Keywords:

Return migration, Transition, Duality, Narratives, Experiences, Gozo.

Author's Bio-Note:

Ylenia Refalo is a Manager I within the Ministry for Gozo and Planning. She holds a Bachelor of Honours in Geography (2016) and a Master of Arts in Geography (2019), qualifications that reflect her strong academic background and deep interest in understanding the complex dynamics of shaping people and places. Her studies have equipped her with a solid foundation in geographical research methods, migration patterns and impacts, environmental policy, and socio-spatial development. Looking ahead, Ylenia is eager to broaden her knowledge by pursuing further studies and exploring courses in complementary fields.

Coming Home?

A Qualitative Study of Return Migration to Gozo

Introduction

Global migration has increased significantly over the past 50 years, rising from 92 million to 232 million between 1960 and 2013 (Wahba, 2015). The OECD's SOPEMI report (2008) notes that around two in five emigrants return to their home country after five years, often transferring savings, education, and skills. Return timing depends on individual experiences and is higher among young people and retirees. Attachment to the home country, developed before or after emigration, plays a crucial role, with some emigrants maintaining dual relationships between the host and home countries. This dual relationship allows for the merging of identifications and a transitional period between leaving and returning (Yehuda-Sternfeld and Mirsky, 2014).

Migration is important in global social and economic dynamics, facilitating talent and manpower shifts for growth (OECD, 2014; UN DESA, 2011). Between 1948 and 1963, southern Europe experienced increased emigration to northern European countries, with low-skilled laborers from agriculture-heavy regions like Greece, Italy, Spain, and Portugal working in industries across Germany, the Netherlands, Belgium, France, Austria, and Switzerland (De Haas, 2011).

Malta experienced the highest post-war emigration in Europe, with 140,000 people leaving between 1946 and 1979. The primary destinations were Australia, the U.K., Canada, and the USA (King, 1979). Termed the 'Great Exodus' by Delia (1982), it saw 3% of the population leaving annually. King's 1976 study revealed an average emigration duration of 7.7 years, with 70.6% returning to their hometowns. Gozitan emigrants showed a higher return rate at 86.3%. Emigration was prompted by challenges like overpopulation and unemployment (Attard, 1997). Government support and the Maltese Church aided migrants, but emigration declined in the late 1960s, leading to returnees (Cassar, 2015). Table 1 below shows Maltese emigration and return migration from 1946 to 1976 studied by King in 1979.

Table 1 - Maltese emigration and return migration (King, 1979).

Destination Country	Emigrants 1946-76		Emigrants returning in 1946-76	
	No.	%	No.	%
Australia	80,952	57.6	466	48.2
United Kingdom	30,870	22.0	326	33.6
Canada	18,251	13.0	139	14.3
USA	9,839	7.0	33	3.4
Other	528	0.4	5	0.5

This study features Gozitan citizens who relocated to their ancestral homeland, and it explores the reasons for their relocation. The main focus of this study is on the transitory period upon arrival that respondents experienced and their aspect of 'duality'. The latter concerns the returned migrants' dual attachments namely, their connection with their country of destination and that with their country of origin. The research delves into the experiences of returnees during the transition phase and the complex process of their migration cycle, with a

particular focus on returned migrants hailing from the island region of Gozo.

In light of all this, the two main research questions of this study are:

1. How do migration transitions affect the individual?
2. Do migrants maintain dual lives – that related to the home country and that to the host country?

Migration and Return Migration

Why do people migrate?

Migration is a complex phenomenon influenced by various factors such as economic opportunities, demographic changes, and personal aspirations. Success in migration is often measured by the prosperity experienced by migrants during their time in another country. Research indicates that longer durations of migration tend to correlate with greater prosperity for migrants, suggesting that extended stays abroad can lead to better outcomes (Unruh, Krol, and Kilot, 2008). Additionally, studies by Monteleone and Torrisi (2010) suggest that the timing of migration plays a crucial role, with early migration in life significantly impacting the likelihood of subsequent migration.

Migration is not random; it is often selective, with individuals who can afford it being more likely to migrate. Return migration patterns also indicate a preference for urban areas over rural ones, potentially reflecting economic opportunities and social factors (Unruh, Krol, and Kilot, 2008). Economic motivations, particularly wage differentials between host and home countries, drive migration decisions. Migrants seek higher wages abroad to support themselves and their families back home (Dustmann,

2003; King, Strachan, and Mortimer, 1985).

Migration is closely intertwined with development, political and socio-economic factors influencing migration patterns. Positive development initiatives aimed at reducing poverty and improving living standards can stimulate migration by creating new opportunities and driving demographic changes (Thieme, 2014). Young migrants, in particular, are motivated by the prospect of better jobs and educational opportunities, as well as the desire to explore the world (Olwig and Valentin, 2015).

Aside from economic factors, demographic pressures and personal aspirations also contribute to migration. High population density and limited economic opportunities in the home country can push individuals to seek opportunities elsewhere (Baldacchino, 2015; Delia, 1982). Family reunification is another significant driver of migration, with many individuals choosing to migrate to join family members already abroad (King, Strachan, and Mortimer, 1985).

Return migration plays a significant role in shaping migration patterns, as it can bring back valuable skills and experiences to the home country. However, it also means the cessation of remittances, which can have economic implications (Thieme, 2014). The temporality of migration is crucial, with early clarification of whether migration is temporary or permanent leading to greater economic benefits (Dustmann, 1997). Additionally, age influences migration decisions, with older migrants being less likely to return to their home countries (Martin and Radu, 2012).

Overall, migration is a multifaceted phenomenon driven by economic, social, and personal factors, with complex implications for both migrants and their home countries.

Trends and Patterns: Migration patterns in a transnational perspective

The timing of migration and return migration is influenced by various factors, as highlighted by the OECD's SOPEMI report, which notes that a significant percentage of migrants leave their host country within five years, with some returning home and others moving to a third country (Martin and Radu, 2012). Returnees are more likely to come from certain regions, such as the EU, the Americas, and Australia/New Zealand, and white immigrants have a higher likelihood of returning compared to non-white immigrants (Dustmann and Weiss, 2007).

Return migrants often originate from rural or small-town areas, with many being poor, unskilled, illiterate, and unemployed individuals seeking better opportunities abroad due to factors like high unemployment and the decline of agricultural land (Calleja, 2008). The majority of migrants are young men, but a significant percentage of returnees are women, and most returnees are under 39 years old (Gmelch, 1980; Labrianidis and Vogiatzis, 2013; Martin and Radu, 2012). Returnees tend to earn high incomes, particularly through self-employment, and may not re-enter the labour market upon returning (Dustmann and Weiss, 2007).

Marital status and family considerations also impact migration decisions, with some migrants bringing their families once they are settled in the host country, while others may marry within the migrant community or have children in the host country, influencing the duration of their stay (Gmelch, 1980; Dustmann, 1993; Steiner and Velling, 1994). Remittances sent back home can extend migrants' stays, while previous migration experience and social networks abroad may shorten their duration (Lindstrom, 1996; Bauer and Gang, 1998).

The reasons for return migration vary, with some migrants forced to return due to familial obligations or difficulties adjusting to life in the host country, such as language barriers or cultural differences (Gmelch, 1980). Overall, many migrants embark on their journey without a specific plan for the future, making decisions based on their experiences and circumstances in the host country.

Going away: Migrant life trajectories

The migration cycle, outlined by King and Strachan (1980), involves planned emigration for savings accumulation abroad followed by return for relaxation in the home country. Attard (1997) views Maltese emigrants as a loss to Malta but a gain elsewhere, highlighting their skills and employment success. Return migration disrupts the traditional one-way journey described by Sternfeld and Mirsky (2014), introducing multiple transitions. Despite emotional distance, people persist in choosing emigration, which comprises various transitions, including both negative and positive aspects. Below are the transitions an emigrant experiences throughout his migration cycle.

Home and Place Attachment

Emotions are present throughout the life of every individual, and they are very evident in a migration cycle. A migrant experiences mixed and contrasting feelings and emotions (Boccagni and Baldassar, 2015).

Buffel (2015) talks about the term 'social insideness', a theory developed by Rowles (1986). It is the idea of attachment to place, referring to the way migrants develop a sense of home. 'Home' is the place where a migrant creates a relationship with the

home country they left behind. Social attachment to the place is facilitated if both the host country and the home country share similar traditions and values. An emigrant's condition is characterized by the uncertainty and tensions surrounding the emotional connection of being 'here' and 'there'. The term 'place attachment' attempts to articulate emotional, symbolic and effective ways of how people think and feel for places. The attachment for a place is an emotive response. It is not developed by memories only of those specific places, but is shaped by the emotional responses to the places (Rishbeth and Powell, 2013).

Communication is pivotal for migrants in maintaining emotional ties with their home countries. Nedelcu and Wyss (2016) emphasize its critical role in reducing detachment and preserving family bonds. Various forms of communication, including remittances, visits, phone calls, and digital media, serve to bridge the gap between migrants and their home countries, although attachment levels vary (Waldinger, 2007). Hung, Xiao, and Yang (2013) highlight the commonality of migrant visits home during special occasions, bolstering family integration and cultural ties. These visits often involve reconnecting with relatives, visiting ancestral graves, and holding gatherings. Despite excitement over new opportunities, migrants grapple with a persistent longing for home, exacerbated by events such as illness or death (Van Ecke, 2005). Language also plays a role, with migrants toggling between their native tongue and the host country's language to maintain dual attachments. Overall, communication acts as a lifeline for migrants, offering hope and connection amidst the challenges of displacement.

Complexities of identity, place and belonging

Briguglio (2001) discusses Gozo's reliance on external economies due to its small and insular nature, a sentiment echoed by Azzopardi and Mann (2007), who highlight the resulting social and commercial isolation. King (2009) further characterizes Gozo's economy as severely limited, reinforcing the island's cultural identity. However, when Gozitans migrate, they often struggle to integrate into new cultures due to these strong ties. Migration entails both gains and losses, with migrants acquiring new skills but also facing financial costs and potential loss of employment and social networks. Identity, crucial to individual uniqueness, is often compromised through emigration, leading to the erosion of familial and cultural ties described by Attard (1997). Migration can induce a culture shock, though familiarity with the host culture mitigates this effect, as suggested by Bhugra (2004). Distance between home and host countries exacerbates feelings of detachment and separation. Emotions such as profound sadness and a longing for home accompany this migration cycle, marking a significant transitional period (Tannenbaum, 2007).

Affiliation and Assistance

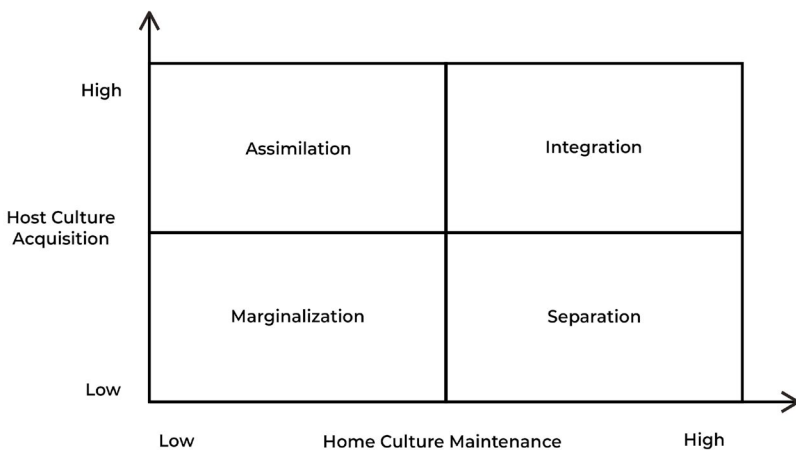
New migrants rely heavily on support from locals, particularly in finding housing and employment upon arrival. As they settle, they seek information on the local culture and norms (Epstein and Heizler, 2016). To foster a sense of belonging, migrants form networks comprising family, friends, neighbours, and colleagues, often through participation in clubs and associations (Harvey and Beaverstock, 2017). These networks can include individuals with diverse backgrounds. Historical examples, such as the Maltese community setting up sports and social clubs in the

late 50s and early 60s, underscore the importance of community engagement in supporting migrant integration (Sherri, 2015).

Integration and Identification

Acculturation was once viewed as a one-dimensional process where individuals adopted the host culture while neglecting their own (Rasmi, Ng, Lee and Soutar 2014). However, Berry's biodimensional model (figure 1 below) suggests that acculturation involves both interacting and adjusting to the host culture, as well as maintaining one's home culture. This leads to four acculturation strategies: assimilation, separation, integration, and marginalization. Assimilation involves adopting the host culture while abandoning one's own, whereas separation maintains strong ties to the home culture but not to the host culture. Integration occurs when interaction with both cultures is established, while marginalization arises when there is no interaction with either culture (Epstein and Heizler, 2016).

Figure 1 – Biodimensional Acculturation Model (Berry, 1997).



Remittances and Savings

Baldacchino (2015) discusses how migrants' remittances to their home countries follow the MIRAB economic model, emphasizing migration, remittances, foreign aid, and public bureaucracy. These remittances are crucial for small island states' economies, as they heavily rely on overseas assistance and foreign money transfers (Tisdell, 2014). Remittances, divided into financial and social, facilitate cultural diffusion, societal changes, and economic development in the home country (Nyberg Sorensen, 2005). Social remittances manifest in various aspects such as housing, businesses, gender roles, and education, fostering modernization and better opportunities (Çaro, Bailey and Van Wissen, 2014). Overall, remittances play a dual role, not only enriching financially but also facilitating societal transformation and modernization.

Returning Home

Attard (1997) examines the decline in emigration from Malta in 1966, attributing it to political changes and global events like the Yom Kippur War and the oil embargo. Delia (1981) notes that from 1946 to 1990, around 155,000 Maltese emigrated, with 39,000 returning. Attard (2007) marks that by 1975, trends were reversed, Malta shifted from being an emigration to an immigration country. King and Christou (2011) explore return migration as a process of belonging and re-grounding, while Munck (2009) discusses the psychological challenges returnees may face. Lindstrom (1996) suggests employment opportunities influence migrants' decisions to stay or return. Factors like family ties, remittances, and caregiving responsibilities also impact return migration (Cassarino, 2004). Urban opportunities in the home country may attract returnees, particularly among rural migrants (Thieme, 2014).

The migration patterns of Gozitan individuals, as examined by various researchers, reveal a significant impact on both their home and host countries. Briguglio (2001) highlights the hard work and financial success of Gozitan migrants, who often return with substantial earnings, influencing the standard of living and cultural behaviour of their households. Cauchi (1999) emphasizes the role of migrants in alleviating economic challenges in Malta through their remittances and skills acquired abroad. Royle (2001) discusses the historical and recent trends of emigration and return migration in Gozo, while Portelli (2016) notes the visible symbols of migration success on Gozitan houses and roads. The ongoing connection to host countries is evident in celebrations such as Canada Day in Gozo, indicating a continued sense of duality for returnees.

Research Design and Methodology

This study employed semi-structured interviews to collect primary data from returned migrants in the U.S, Canada, and Australia. The researcher utilized a set of ten open-ended questions designed for a conversational style, allowing flexibility for additional inquiries. The in-depth interviews aimed to gather qualitative data on the respondents' experiences, transitions, and integration upon returning to Gozo. Questions were clear thus encouraging respondents to share significant incidents in their migration cycle. Interviews, conducted in Maltese, were held in locations chosen by the respondents, promoting a comfortable environment. Consent forms ensured confidentiality. The study also incorporated visual data, featuring photographs illustrating migrant distinctions in residence and attitudes. Interviews lasted 45-60 minutes and were audio-recorded and transcribed.

The study involved audio recording, transcription, and thematic analysis of interviews conducted in Maltese. Extracts were also translated into English. The first stage focused on transcription, followed by a detailed reading to highlight important aspects. The second stage involved coding transcripts to identify main themes related to the research questions using thematic analysis. Closely related ideas formed categories and themes. In the final stage, main themes were analyzed and compared with primary data.

The study utilised various secondary data sources, including journal articles and official reports, to analyze return migration transitions. Fr. Lawrence Attard's 'Profiles in Maltese Migration' (2003) presented life migration histories and socio-economic conditions in Malta from 1792 to 2000. Also, the 1995 census from the Gozo Public Library offered detailed statistics on return migration, particularly in Gozo localities.

A Qualitative Analysis and Discussion of Return Migration to Gozo

This study explores experiences of young Gozitans emigrating for better life. Themes and subthemes depict migration cycle challenges and coping strategies.

Transitions

This study highlights two transitions: from home country (Gozo) to host country (Australia, Canada, U.S.), and back. Each carries unique challenges as discussed below. Sentences in inverted commas are quotes extracted from the original interview transcripts.

Leaving the home country, Gozo

The literature review underscores the predominant reason for migration from Gozo as its limitations and insularity. Post-World War II, emigration from Malta became a fundamental policy to address overpopulation and unemployment. Interviews revealed poverty and coping with high population density as primary drivers for migration, highlighting Gozo's constraints. Government assistance, particularly in covering travel costs, facilitated migration for many, "there was a lot of poverty and even the economy was very bad so the government did everything to encourage people to migrate". Participants expressed a mix of excitement and sorrow about their departure, echoing Boccagni and Baldassar (2015), "everyone knew that what I was going to do was as an opportunity but the separation is terrible". Despite the challenges, migrants risked leaving their home countries in pursuit of a better life, enduring separation's hardships for potential long-term gains.

Differences in Identity and Place

Participants in the study expressed various impressions about life abroad, highlighting aspects like the size of their new country, cultural transitions, and economic conditions. This is in line with research by King (2009) highlighting Gozo's economy as severely limited. Many faced culture shock upon arrival, needing to adapt independently. Those resisting assimilation likely encountered greater challenges. Some embraced change positively, notably finding employment and utilizing babysitters, altering family dynamics, "this change made me grow and experience different cultures and traditions". Religious practices shifted due to time constraints and fewer nearby churches. Economic disparities between their homeland, Gozo, and the

host country were evident, “There were a lot of cars on the road ... even the buildings were very different. The people and the way they dressed were completely different. I remember there were even some bridges”. While most appreciated the wealth in their new environment, comparisons with Gozo hinted at underlying attachment. The accounts underscored migrants' departure from Gozo due to limited comforts and opportunities, revealing diverse adaptation experiences. Adaptation varied among individuals, influenced by personal timelines and stages of adjustment to a new identity and environment.

Welcomed in the host country

Although differences in identity and place were quite evident in the host country, there were many interviewees who narrated that they were welcomed in the host country. Participants who had friends or family in the host country experienced less fear and stress, aiding in a smoother transition and settlement. This pre-existing support network facilitated adaptation and was crucial for migrants, emphasizing the significance of family bonding. The study underscored the importance of familial connections particularly in Gozo, as studied in the literature review where migrants missed their families dearly. Family cohesion remained strong even after migration, with relatives in the host country providing a sense of welcome and support “the fact that you would know someone as soon as you arrive is different”. This aligns with prior research by Epstein and Heizler’s (2016) highlighting the necessity of local assistance for migrants' housing and employment needs “I had my aunty and uncle and I went to live with them. Apart from that I had various friends from my locality in Gozo”, “my husband’s brother took me to the factories and I found a job there and started to work”.

Overall, travelling with companions, especially family, increased the likelihood of successful integration by providing a reliable support system.

Returning to Gozo

The migration cycle ends with the last transition that of returning to Gozo. The interviews revealed that participants returned to Gozo primarily due to distance from family and a sense of belonging, “both my parents and my husband’s parents were getting old and we wanted to spend more time with them”. This sense of belonging and re-grounding was highlighted by King and Christou (2011). Nostalgia for Gozo and the progress in the Maltese Islands post-1980s also influenced their decision, “Gozo had advanced a lot and therefore it was easier for us to return. We also wanted that our children would be brought up in Gozo because we love Gozo’s environment”. However, returning was not without challenges; some found it complicated and emotionally conflicting, torn between leaving their new life and reuniting with family. This highlighted the importance of kinship relationships and the stress of migration transitions. Some had to leave family behind, illustrating their strong attachment to Gozo. Others stayed abroad for years to ensure a collective return with their entire family, “so my husband and I decided to wait for our daughter to finish her studies and then we returned together to Gozo”. Overall, returning migrants faced complex emotions and practical considerations in their journey back to Gozo.

Duality

Migrants experience duality, being bilingual, adapting between home and host cultures, and maintaining ties with both countries. Their journey is multi-directional.

Communicating with family in Gozo

Gozitan migrants landing in their host country ensured to promptly inform family back home, a comforting ritual eagerly awaited. Communication in the 1960s primarily relied on letters due to poor telephone connectivity, taking weeks for replies. Interviews revealed the profound impact of telephone calls, offering immediate solace through familiar voices; “I would never forget my children and my wife’s voice on the telephone”. Photos from home served as motivational anchors, nurturing resilience; “I used to keep these photos and when I feel sad I used to look at them to comfort myself. I still have these photos till today”. Migrants expressed love through parcels, containing clothes and sometimes money, as a tangible connection to their families in the home country as studied by Waldinger (2007). These gestures symbolized care, solidarity, and a desire for familial happiness, reinforcing ties and providing emotional support amid the challenges of migration.

Visiting Gozo

Apart from communicating with family in Gozo, the importance of duality was felt when interviewees narrated about when they visited Gozo. From the interviews, migrants emphasised how they were initially embraced by the opportunities in their host country but still felt a strong pull towards their homeland, Gozo. Visiting Gozo became a ritual, primarily to reunite with family and relive memories. Holiday visits, especially during Christmas or village feasts, reinforced family values, as per Hung, Xiao, and Yang (2013), “I would feel in seventh heaven when I was in Gozo especially during such occasions”, “they are the best moments to spend with your family”.

However, such visits evoked mixed emotions. Interviewees narrated how joy of reunion clashed with homesickness upon return to the host country, sometimes igniting a desire to permanently return to Gozo, “sometimes you miss it more, since the first time you may have been excited to see what the host country offers, but then after a holiday in Gozo you would know where you are going to”. Despite challenges, migrants maintained profound ties with Gozo, viewing it as their true home.

Seeking the company of other Gozitans in the host country

The analysis reveals the formation of a dual identity among migrants seeking companionship with fellow Gozitans in their host countries, as documented in the literature by Harvey and Beaverstock (2017). Respondents pointed out that clubs and associations established by Maltese and Gozitan immigrants in countries like the U.S., Canada, and Australia provided a sense of welcome and security, fostering the maintenance of their cultural identity “We used to go to the Maltese and Gozitan clubs and I used to really have fun. I used to wait eagerly for these moments. There were people that we knew from Gozo”. Interviewees expressed joy in frequenting such clubs, where they could find familiarity, kinship, and a taste of home through Maltese food and village feasts. However, while these clubs offered comfort, there were others that narrated how these evoked distress and nostalgia, reminding them of their homeland and increasing their longing to return, “I used to feel sad as well because you miss Gozo more”. Despite this, interacting with fellow Maltese and Gozitans upon arrival in the host country was a common first step for migrants to share experiences and uphold their cultural heritage.

Language

Additionally duality is very evident in terms of language. The interviews revealed that Gozitan migrants in the host country often preferred using Maltese over English for communication, indicating a desire to preserve their mother tongue. They felt comfortable conversing with fellow Maltese or Gozitans in Maltese, fostering a sense of identity and belonging, “The fact that we used to talk in Maltese with other Maltese and Gozitans, I used to feel like I was at home”. Maltese language and the Gozitan dialect was prevalent in Maltese clubs and associations, facilitating cultural preservation and language transmission to their children born in the host country, “When I used to meet other Gozitans in the clubs and sometimes even in the streets, we used to talk in Gozitan and I used to enjoy it because in that way I would never forget the language of my birth place”. Despite efforts to maintain their language, the influence of the host country's language was evident in accents and English word usage. This underscores the migrants' adaptation to their new environment while retaining aspects of their cultural identity through language. Overall, language played a vital role in fostering connections and preserving cultural ties within the migrant community as highlighted by Hung, Xiao, and Yang (2013).

Praising the host country

Narratives from the interviews reveals that many prosperous Gozitans returned home, significantly impacting households and the island's culture. Their wealth led to spacious homes and improved living standards. Returnees maintained ties to their host countries, evidenced by house names like 'God Bless Australia' and forming associations like the Canadian Association in Gozo, “Australia still forms part of our lives; we have a kangaroo

figurine at the front of our house”. Some observed national holidays, such as Canada Day and Independence Day, raising flags and organizing events. Along similar lines, Portelli (2016) highlight how duality was evident through retaining artifacts. However, some migrants faced tragedy abroad, leading to a single identity upon return, “I did not fly any Canadian flags or celebrate Canada Day because those things brought me a lot of nostalgia and it reminds me of my late husband and then I get sad a lot and so it is better not to do such things”. Overall, returnees preserved connections to their former homes, reflecting a dual identity and cultural retention.

Going back to the host country?

Returnees to Gozo experienced a swift readjustment despite initial feelings of danger and conflict. They viewed visits to their host countries as holidays rather than resettlement opportunities. Memories and nostalgia accompanied return visits, reinforcing the host country as a second home. This was also due to the fact that some interviewees narrated that they still have family in the host country, “I still have my family, my brothers and my sisters”. Technological advancements facilitated travel “It is true that there is quite a distance; however, today with the advances you do not even get bored on the airplane and even the airplanes are safer and more modern”, though some longed for visits they hadn't yet had, “I really wish to go again with my daughter and her family so that I could show them where we used to live and narrate to them what we used to do”. Relationships formed in the host country contributed to a sense of duality in identity, distinguishing them from their homeland. This highlights migrants' efforts to maintain connections to their former country, culture, and identity, indicating a complex interplay between origins and adopted homes.

Conclusion

The Maltese islands have now reached a stage of development in which very few people leave the islands permanently. Those who move to other countries do so for short periods of time such as for studies or business. The employment rates and the GDP per capita rates have increased significantly, and so people do not need to emigrate for jobs and to enjoy a decent standard of living.

This type of study is significant as it contributes to the understanding of the Gozitan society and its culture. It highlights the efforts aimed at the social and economic development on the island in particular and the whole country in general. Throughout this study it became clear how the majority of the participants held on, to the ideas and traditions of their host country by setting up organizations and clubs in Gozo linked to those countries. As time goes by, more support and recognition is being given to these returned migrants. Both the state and the Church in Malta, as well as private organizations, organize activities and set up memorials for such returnees.

As this study of 'Coming Home? A qualitative study of return migration to Gozo' has shown, transitions and duality in the migrants' cycle and experience has been a defining feature of the Gozitan identity.

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Travel Time and Gozitan Commuters

Marthese Cini Davies

Abstract:

This article investigates inter-island commuting behaviour and travel time. It specifically studies Gozitan commuters who travel regularly between Gozo and Malta. By comprehending the current situation and studying the performance of existing transport modes one can recognize some attainable recommendations to ameliorate the commute between the island of Malta and Gozo.

Travel time studies are crucial for transport geographers, particularly on island archipelagos. Small islands like Gozo have to turn to outside connections for their infrastructure. The main areas that will be addressed in this article are about the current travel characteristics of Gozitan commuters, the current travel times experienced by commuters and their attitudes about the current ferry service that operates between the islands. It finally takes into consideration the attitudes of Gozitan commuters towards the value of time and a potential infrastructure upgrade such as the proposed underwater tunnel and the implementation of a fast ferry service between Gozo and Malta. The latter has been recently introduced. The proposed underwater tunnel will take a long time to be completed and the main focus of this article is the short to medium term solutions.

There is not much evidence on the topic of travel time that is locally published. With the help of this research this gap in local literature concerning the Gozitan commuters crossing daily to Malta will be filled. Thus, this will reveal current and fundamental proof to assist decision makers and the community overall on the feasibility of a better and efficient transport infrastructure between Malta and Gozo.

Keywords:

Travel time, Travel behaviour, Extreme commuting, Transport infrastructures, Fast ferry, Tunnel.

Author's Bio-Note:

Marthese Cini Davies always had a passion for history and geography in her education. She finished her B.A Degree in Geography (Hons) and undertook her M.A in Geography where she graduated in 2021. She is from the island of Gozo and the concept of commuting to Malta for work always intrigued her, therefore decided to do her M.A degree on this subject.

Travel Time and Gozitan Commuters

Introduction

Gozo is an island which has a population of around 40,000 inhabitants and has an area of only 67 square kilometres. Gozo is linked to Malta by a scheduled ferry and a fast ferry service. Malta has many sheltered harbours, whilst Gozo has only one sheltered harbour and it is Mġarr. This harbour was man-made to unite the islands in the 1970s (Conrad et al., 2011). Because of this solely linkage, the island of Gozo is fully contingent on the main island of Malta (Chaperon & Bramwell, 2013).

It is calculated that approximately one in five employed people who live in Gozo commute to Malta for their employment (NSO - Regional Statistics Malta, 2023). It is a fact that there was an increase of 8.3% in the number of passengers that traversed between the harbours of Ċirkewwa and Mġarr between the years of 2020 and 2021 (Table 1.1). There is a strong need for a stable sea connection between Malta and Gozo since many people commute to Malta for work.

Table 1.1 - Sea transport between Malta and Gozo by day of the week.

<i>Day of the week</i>		January - March		Change	Percentage Change
		2020	2021	2021/2020	2021/2020
<i>Trips</i>	Monday	4,068	4,327	259	6.4
	Tuesday	4,054	4,230	176	4.3
	Wednesday	4,081	4,260	179	4.4
	Thursday	4,231	4,284	53	1.3
	Friday	4,315	4,673	358	8.3
	Saturday	4,031	4,150	119	3.0
	Sunday	4,272	4,501	229	5.4
	Total	29,052	30,425	1,373	4.7
<i>Vehicles</i>	Monday	216,515	235,626	19,111	8.8
	Tuesday	203,008	228,356	25,348	12.5
	Wednesday	213,155	235,993	22,838	10.7
	Thursday	222,535	239,956	17,421	7.8
	Friday	251,282	281,471	30,189	12.0
	Saturday	218,130	251,725	33,595	15.4
	Sunday	227,513	254,502	26,989	11.9
	Total	1,552,138	1,727,629	175,491	11.3
<i>Passengers</i>	Monday	511,969	542,305	30,336	5.9
	Tuesday	464,347	518,651	54,304	11.7
	Wednesday	499,009	545,468	46,459	9.3
	Thursday	522,605	541,066	18,461	3.5
	Friday	594,194	646,132	51,938	8.7
	Saturday	558,571	626,484	67,913	12.2
	Sunday	623,286	666,914	43,628	7.0
	Total	3,773,981	4,087,020	313,039	8.3

Source: National Statistics Office, Transport Publication, 2022

There are two available transport modes that connect the islands of Gozo and Malta. A ferry service that connects the islands linking

Mġarr Harbour in Gozo to Ċirkewwa in the North of the island of Malta and a fast ferry service which connects the island from Mġarr Harbour in Gozo to Valletta in Malta. The main mode which is used between these two is the slow ferry service which also carries vehicles apart from passengers. There are currently four ferries in this service, which offer a crossing every half an hour (in peak hours). They are named M.V. Ta' Pinu (commissioned in 2000), M.V. Gaudos (2001), M.V. Malita (2002) and a latest new addition which is named the MV Nikolaus (2019). The Gozo Channel started operating the services under a monopoly (and public service obligations) in 1979 (Gozo Channel, 2020).

The connection between the two islands was identified as part of the Trans-European Transport Network (TEN-T) Comprehensive Network as an important link connecting the two islands (MacDonald, 2012). The link features the two ports of Mġarr and Ċirkewwa and the main roads leading to them and connecting them to the main urban centres.

The theory of a fixed link supposedly reduces the time impediment along short sea channels. However, documentation from Europe and the US from the 1930s and 1950s display that fixed links could raise traffic by a percentage of between 40% and 210% (Knowles, 2006). Mott Macdonald (2012) administered an investigation of the tunnel link potentials between the islands of Malta and Gozo. This research proposed four diverse possible tunnel choices. Mott Macdonald's (2012) conclusion was that a tunnel between the islands was attainable.

An additional local study regarding the proposed tunnel was conducted by Dr. Gordon Cordina and appointed by for the Gozo Business Chamber and Transport Malta (2015). This report suggests that there is the necessity for a tunnel since there are socio-economic divisions between the islands of Malta and Gozo

owing to the double insularity, remoteness and the compactness of Gozo. The verdict of this report suggests that from an economic viewpoint, the tunnel is the perfect choice, that is, it issues the most economic benefit (Cordina, 2015).

Travelling is an essential component in the people's everyday life. It is required for them to go to work, shop, and visit friends or family (Van Wee et al., 2013). Travel is frequently perceived as a liability that takes time and money. The travelling behaviour of people is necessary to study as well. It can aid to recognize and comprehend which mode of transport commuters use the most and why, along with the justifications behind particular destination selections. To determine on their choice of travel, commuters regard the purpose and distance of the trip, perceived comfort, service quality, travel time, safety and other factors.

The term travel time is typically depicted as a definite period of time which a person spends traveling. This is typically directed to the commuters in the population, where the time spent traveling from home to work, is estimated and researched. In some conventional researches about transport, travel time is always regarded to be a derived demand. Travelling is conducted to gratify one's need to arrive at a specific destination (Ortuzar and Willumsen, 2011). There is also the theory of extreme commuting which can be described as "long duration or long-distance commuting" (Vincent-Geslin & Ravalet, 2016). When people commute to their workplace and take longer than anticipated or the distance is longer than the actual spatial location of their residential house and their place of work, excessive commuting occurs (Horner, 2002).

Prolonged time spent commuting can then generate stress which causes a low satisfaction with regards to the salary of the job and the place where one lives. This frustration creates future issues with, for example, life satisfaction (Sha et al., 2019).

An acceptable transport system should always cater mainly for the commuter himself. The protection, well-being and mobility of the commuter is essential and should always be catered for. It is quite apparent that the car has achieved this objective quite remarkably in today's society (Chapman, 2007). When a commuter chooses the mode of travel, travel time is not the only component which is observed. Travel mode choice has also an effect on the commuter's choice behaviour concerning the route (Lo & Luo et al., 2006). Perceived comfort is also a significant characteristic that aids commuters choose a certain mode of transport. With regards to public transport commuters can consider seat availability, the quality of the journey, time use whilst travelling and the easiness of using public transport vehicles (Bouscasse & De Lapparent, 2019).

Methods used to obtain the results

For this research, a mixed-method approach was found to be the best suited method. By the use of this method, the researcher acquires considerable data and there is greater reliance in the results, while single method deficiencies are reduced. This method also enforces the quantitative findings with the qualitative ones (Creswell & Piano Clark, 2011).

The primary data was collected by the use of an online questionnaire. As stated by the National Statistics Office report of 2019, there were 3,400 Gozitan commuters who crossed from Gozo to Malta. In this respect, three hundred and fifty (350) questionnaires were assigned amongst the sample of participants (approx. 10% sample). Telephone calls were also chosen as a method of distribution. The recognition of the sample and the target population was a crucial element so that the gathering of the primary data could begin. The target population for this research were the Gozitans who commute everyday to Malta to their place of work. A URL link was created for

the online questionnaires through Google forms, which was then sent to participants who met this basic requirement. This link was shared on social media platforms and groups that concerned specifically the Gozitan commuters.

Apart from the distribution of online questionnaires, two semi-structured interviews were also administered as means to gather primary data. These were done with two policy makers which are Mr. Joe Cordina, the Chairperson of the Gozo Channel, and Mr. John Borg, the Permanent Secretary within the Ministry for Gozo. These semi-structured interviews were fundamental for this research, since they reinforced the study as a whole by contributing relevant material regarding the proposed infrastructures and the current ferry system. The information from the semi-structured interviews was examined by recognizing and presenting the recurrent themes in the interviews.

The examination of the quantitative data incorporated statistical tests which were executed with the use of the program SPSS (Statistical Package for the Social Sciences). This type of data analysis is used by several researchers for compound statistical data analysis. This type of analysis was necessary and aided to bring out correctly the analysis of the results. The computer program SPSS, contains and incorporates a succession of computer programs to simplify the understanding of information of questionnaires and surveys by the user (Gaur & Gaur, 2009).

Several tests were carried out using the program SPSS to analyse the primary questionnaire data. One of the tests is called the Chi-square test, which helped to analyse the results, since most of the variables consisted of a nominal categorical scale. This was done to examine the relationship between any two variables. There are several studies which gather data on categorical variables and are shortened into a series of counts. These counts are organized into

a tabular arrangement which is known as a contingency table. The Chi square test values can be used to determine if there is a relationship between the two variables examined (Singhal & Rana, 2015).

The Friedman test was also conducted by using the program SPSS. This test correlated the mean rating scores administered from the Likert scale to a particular question which described the characteristics of the ferry service in the questionnaire. These rating scores ranged from Poor to Excellent. The Friedman test was the most applicable test for this question, since the values of the variable are not associated to each other and are independent of each other (Porkka et al, 2008).

The Kruskal-Wallis test was also used to examine the data. This test is used when one has a nominal variable and a ranked variable. This test is a nonparametric method, which means, that it does not depend on the supposition that the data is extracted from a probability, and it will test if the mean ranks are alike in all the groups (Salkind, 2010).

Secondary data was also collected from different sources, such as, journals, research papers and reports, together with data from the National Statistics Office.

The Results

From the statistical investigations that were conducted, it resulted that a large number of the participants, work in localities such as Imsida (25.4%), Birkirkara (13.4%) and Valletta (8.6%). This result mirrors accurately the Census of Population and Housing 2011. NSO (2016) portrayed, that the highest percentage of Gozo and Comino residents who work in Malta were employed in the Northern Harbour and Southern Harbour regions. Imsida and Birkirkara fall under the

Northern Harbour whilst Valletta falls under the Southern Harbour region.

The majority of the sample population who participated in this study, commuted very frequently to work (5 days a week - 61.4%), while a small percentage of the sample population commuted 3-4 days a week (17.4%). This remarkably shows us that these commuters undergo an average of 4 hours commuting every day, which can be calculated around 20 hours each week.

The survey participants in this research, were also questioned to determine the mode of transport used to support their commute to work. The results show that the most prevalent transport mode was the private car both for their journey to work and back home. This research stipulates that Gozitan commuters can be categorized as extreme commuters. They spend a lot of time travelling in order to reach their place of work. The journey from home to work takes them around 1 hour 15 minutes to 1 hour 30 minutes (29.9%), 1 hour 30 minutes to 1 hour 45 minutes (28.7%) and over 1 hour 45 minutes (23.3%). Their journey back home is also categorized as extreme commuting. The results show that the highest percentage of commuters take 1 hour 30 minutes to 1 hour 45 minutes (30.1%), over 1 hour 45 minutes (28.1%) and 1 hour 15 minutes to 1 hour 30 minutes (25.8%) (Table 1.2). According to Vincent-Geslin & Ravalet (2016), extreme commuters add up to between 5% - 10% of the commuting population. They label extreme commuting as people who need to commute more than 2 hours, minimum three times per week. Examples in some European countries include Sweden, the Netherlands, and France, as well as the United Kingdom and Switzerland.

Table 1.2 – Percentages and frequencies of the travel time for the sample of commuters (home to work and work to home).

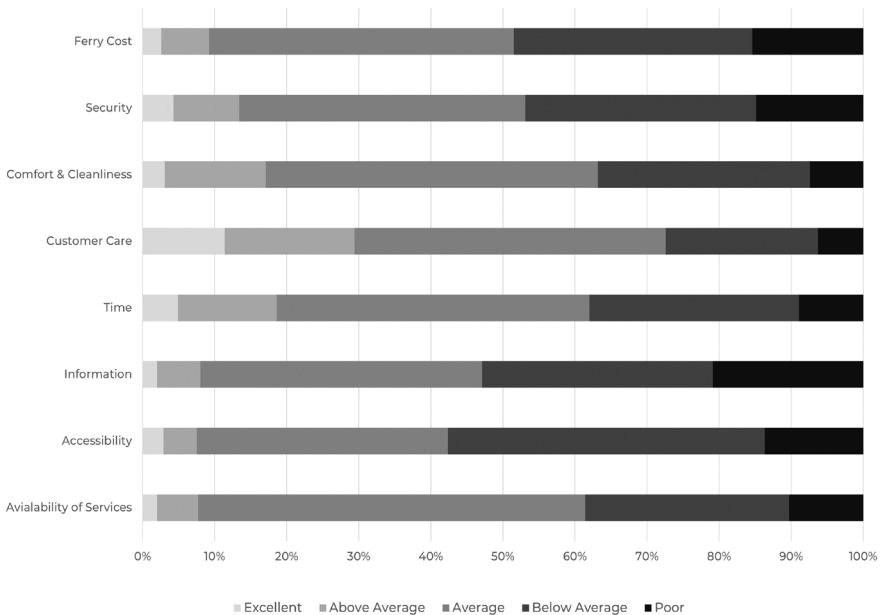
		Frequency	Percent
Avg. daily travel time (hour-work)	45-60 minutes	7	2.0
	1 hour - 1 hour 15 minutes	56	16.0
	1 hour 15 minutes - 1 hour 30 minutes	105	30.0
	1 hour 30 minutes - 1 hour 45 minutes	101	28.9
	Over 1 hour and 45 minutes	81	23.1
	Total	350	100.0
Avg. daily travel time (hour-work)	45-60 minutes	4	1.1
	1 hour - 1 hour 15 minutes	52	14.9
	1 hour 15 minutes - 1 hour 30 minutes	90	25.7
	1 hour 30 minutes - 1 hour 45 minutes	106	30.3
	Over 1 hour and 45 minutes	98	28.0
	Total	350	100.0

Interestingly enough, when we used the statistical tests we found that there is also a relationship between gender and the average travel time of the commuters, which revealed that females have longer commutes than their male counterparts.

Analyzing the attitudes of the Gozitan commuters with respect to the current ferry system was the next step in the research. When the Likert scale was examined in one of the questions in the questionnaire, most of the commuters chose the ‘average’ score for almost all the characteristics listed in the questionnaire, which were, availability of service, information, time, customer care, comfort and cleanliness, security and ferry cost (Figure 1.1). The characteristic accessibility, was selected to be ‘above average’ by the majority of the

commuters. This result was furthermore enhanced with a Friedman test. The results showed that the best service quality criterion was 'information'. This was followed by accessibility, ferry cost, security, availability of service, comfort and cleanliness, time and customer care. All attributes indicated good perceived quality except for customer care. According to the Kruskal-Wallis test and its variables of characteristics of ferry and commuting days, the results were as a matter of fact very compelling. Regular commuters who use the Gozo ferry classify 'comfort and cleanliness' and 'security' as their best service quality indicator, whilst less regular ferry commuters classify 'availability of service' and 'information' as their best service quality indicator. The 'Poor' score always remained between the percentage range of 2 – 5%, except for the characteristic for customer care where 11.4% of commuters ranked it poorly. On the other hand, the 'Below Average' score was mostly predominant in the 'customer care' and 'time' characteristics with 18.0% and 13.7% respectively (Figure 1.1).

Figure 1.1 – Values and percentages of characteristics of ferry by the sample commuters.



The inclusion of the fourth ferry within the boat fleet of the Gozo Channel Company seems to have had very positive results with the sample of commuters. On the other hand, with regards to the attitudes of the commuters towards the infrastructure upgrades as proposed by Government, a large number of these travellers were opposed to the building of the tunnel (63.7%). The most prevalent reason was that Gozo would lose its character and its identity. On the contrary, results showed that the commuters' attitude in relation to the then proposed fast ferry was a positive one. The majority of the participants were in favour of obtaining the service (65.7%) and was most popular with Gozitan commuters who worked in or near Valletta. With reference to the concept of travel time savings, data gathered from the semi-structured interviews showed that travel time would only be lessened slightly with the building of the proposed tunnel. It would save the commuter's the ferry waiting time but road traffic congestion would still exist especially from Pembroke to Valletta. Nonetheless, it persisted to be the most desirable choice for a fixed link between the islands.

The outcome from the questionnaire also show that the value of time for Gozitan commuters was dominant. The reason why commuters were in favour of potential infrastructure upgrade revolves around the value of time. The most popular attitude for those who were in favour of the tunnel was that they expected a quicker connectivity and so the accessibility to Malta would improve (26.6%). Unfortunately, the fixed link possibility will take a long time to be completed even though some Gozitans are in favour of it.

Conclusion and Suggestions

After examining the literature and after analysing the questionnaires and the semi-structured interviews, several suggestions were put forward as part of this study. Incentives need to be introduced to

make public transport more popular amongst the commuters. As seen from the findings, the majority of the sample of commuters are using their private car (Ĉirkewwa to work - 50%, work to Ĉirkewwa - 49.7%), while just a small percentage use the public transport (Ĉirkewwa to work – 13.4%, work to Ĉirkewwa -14.6%). Studies such as Ben-Elia & Ettema (2011), show that incentives such as rewards really work to help commuters change their travel behaviours. On the other hand, Gardner (2009) expresses that the travel behaviour of commuters will not be changed by incentives if they have a strong travel habit.

Also, one may recommend that all the existing studies and documents about the proposed infrastructures should be made public. This is necessary since the population requires to be better informed about the current scenario. The policy makers interviewed in this research expressed that either they did not know about these documents or that these studies were made but they were not yet available for the public.

The proposed introduction of a fast ferry at that time was very popular amongst the sample of commuters since 65.7% were in favour. Accordingly, one can recommend more studies to find a reliable way to make this service sustainable so it can still operate in the long run.

Moreover, after the analyses of the questionnaire, predominately the question that focuses on the characteristics of the ferry and how the commuters ranked it, one can propose some solutions. The most characteristics that received low rankings were the 'customer care' and 'time' characteristic. One can propose a live chat where commuters and persons who use the service can ask questions and get replied to instantly. On the other hand, with respect to the characteristic of 'time', one can propose more frequent trips during holiday seasons and long weekends to lessen the time spent waiting by the users.

As a final consideration, during the COVID-19 pandemic many commuters travelling to work from Gozo to Malta have experienced that much gratifying tele-working. The ferry is directly affected by bad weather, especially in the winter months. Proof of this are some articles and documents published on the subject. Occasionally the ferry does not operate and sometimes it goes around the island of Comino, which extends the trip by an extra 20 minutes. The arrangement of tele-working to commuters can be an excellent option to minimize their need to commute especially in bad weather. This pandemic was the appropriate opportunity to show that tele-working, at least in most of the days, can really be implemented and can minimize the pressures of extreme commuting. There is a need of balance within the relationship between the work and the life of these Gozitan employees. A Gozo tele-working scheme has been put in motion in 2020 by the Ministry for Gozo. It is designed to aid employees working in Malta who are employed within the private sector. The scheme gives help to the employers, who are situated and registered in Malta, to help their Gozitan employees, by giving them the opportunity to work from home if their work tasks allow this adjustment. With this prospect, the relationship between work and life of the Gozitan employees can be stabilized. It is commonly attested that this adaptability allows the employee to be continuously productive. Instead of using the time to travel, it can be exchanged into time spent working from home (Ministry for Gozo, 2020).

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Predictive Modelling of Sea Debris Around Maltese Coastal Waters with Special Reference to Gozo

Mark Dingli

Abstract:

The accumulation of sea-surface debris around the coastal waters of Malta and Gozo poses significant ecological and environmental challenges that negatively impact marine ecosystems and human activities. This issue is exacerbated due to the lack of an effective system tailored to predict surface-debris movement specifically for the Islands of Malta. To address this gap, a pipeline that combines a machine learning-based prediction system with a physics-based model is proposed. This pipeline uses data on historical sea-surface current velocities to forecast future conditions and visualise debris movement. Central to this system are two machine learning models trained to predict surface velocities for the next 24 hours for a specific area. These predictions are then utilised in a Lagrangian model to simulate and visualise the debris movement, providing insights into future dispersion patterns. A comparative evaluation of both models using real-world data is made to determine which one performs best in this application. This method offers a tailored approach to addressing sea-surface debris around Malta and Gozo by accurately predicting sea-surface current velocities and visualising debris movement, improving cleanup operations and marine conservation strategies.

Keywords:

Machine Learning, Geosciences, Artificial Intelligence, Lagrangian simulation, Prediction of sea-surface current velocities, Oceanography, Environmental Modelling, Marine debris simulation, Marine conservation.

Author's Bio-Note:

Mark Dingli graduated with a Bachelor of Science in Information Technology (Honours) in Artificial Intelligence from the University of Malta in 2023. A driven and detail-oriented Junior Data Engineer at RightShip, he has a strong foundation in machine learning techniques and data science, he is particularly passionate about leveraging data to solve complex, real-world problems. Mark is also a published author, contributing to research in AI and Geosciences.

Predictive Modelling of Sea Debris Around Maltese Coastal Waters with Special Reference to Gozo

Introduction

Sea-surface debris around the coastal waters of Malta and Gozo presents a significant environmental issue. Predominantly composed of plastics, which constitute 82% of all man-made floating materials encountered in the Mediterranean Sea, this debris endangers marine life, disrupts ecological balance, and compromises the ecological integrity of coastal areas. Studies reveal significant negative effects, ranging from harm to marine wildlife due to ingestion and entanglement to the disruption of natural habitats. The impact on coastal ecosystems extends beyond the environment, affecting economic sectors reliant on marine health, such as tourism and fishing. Further research covers the long-term ecological consequences, highlighting the urgent need for effective management and mitigation strategies since the geological characteristics of the Mediterranean Sea make it difficult for surface debris to escape the area naturally, resulting in it accumulating.

This problem is further aggravated by the lack of an effective system that can predict the movement of this surface debris since, as of this writing, there exists no system that addresses this challenge

for the coastal areas around Malta and Gozo. This absence impedes effective interventions to mitigate environmental harm and opens an opportunity for the implementation of a system that aims to address an urgent ecological issue, which is widely recognized as a global crisis. By fulfilling this need, this research aims to provide accurate predictions that can guide effective cleanup operations and inform strategies for long-term marine conservation around the Maltese coast.

In this research, a Machine Learning (ML) technique and a physics-based Lagrangian model are implemented to address environmental issues of sea-surface debris. At the core of this study is a pipeline that uses historical data to predict the next 24 hours of Sea-Surface Current (SSC) velocities. These predictions serve as inputs to the Lagrangian model, enabling it to simulate the movement of surface marine debris. Long Short-Term Memory (LSTM) and Gated Recurrent Unit (GRU) models are utilised due to their efficacy in handling time-series data relevant to the study. Both models are then evaluated and compared with a focus on their predictive accuracy and the quality of their visualisations. This offers valuable insights into marine conservation efforts and enhances decision-making processes for the management of marine debris around the Maltese Islands. The source code and data sets used in this study are publicly accessible on GitHub¹.

The aim of this project was to create a system that simulates and predicts the movement of marine debris in the coastal waters of Malta and Gozo. To achieve this, the following objectives were identified:

¹ https://github.com/markdingli18/FYP_Mark_Dingli.

- *Data integration*: To preprocess the SSC velocities datasets to ensure compatibility and consistency for input into the ML and Lagrangian models.
- *ML model development*: To develop both LSTM and GRU models to predict future SSC velocities. These models served as crucial components of the forecasting system, leveraging their respective strengths in time series data processing to ensure accurate predictions.
- *Lagrangian model development*: To develop a physics-based Lagrangian model for simulating the movement of surface marine debris, utilising historical data to ensure accurate simulations.
- *Integrating the ML models with the Lagrangian model*: To integrate the ML models' predictions into the Lagrangian model. This integration aimed to create future simulations and visualisations of marine debris movement, enhancing the project's predictive capabilities.
- *Comparison of AI models*: To conduct a comparative evaluation of both LSTM and GRU models, focusing on their predictive accuracy and the quality of the final visualisations.

Background

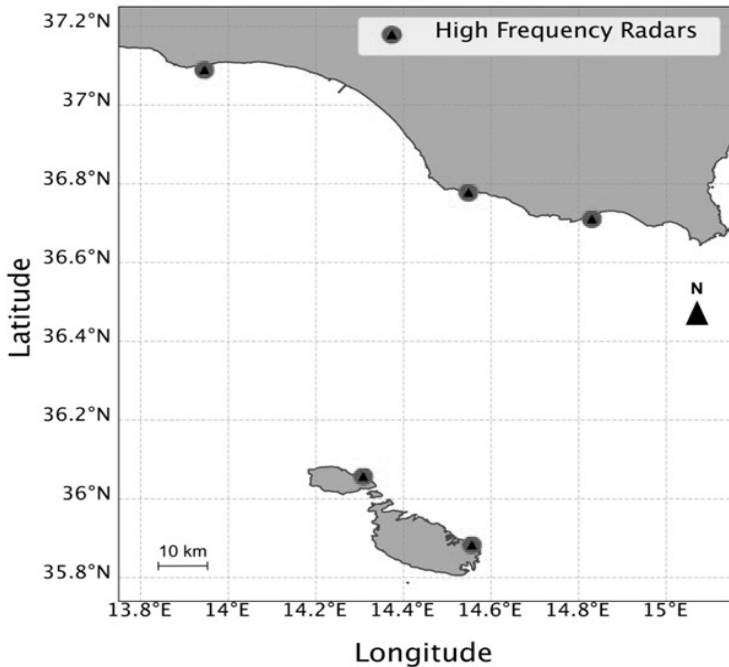
In this study, a data set provided by the Department of Geosciences² at the University of Malta was used. This data set consists of SSC velocities recorded in hourly increments across four years, spanning from January 2020 to December 2023. The data is composed

² <https://www.um.edu.mt/science/geosciences>.

of several variables, including longitude, latitude, time, and SSC velocities denoted as west–east velocity (u) and north–south velocity (v). The data’s geographical scope was defined within the coordinate boundaries of 14.15° E to 14.81° E in longitude and 35.79° N to 36.30° N in latitude.

The data points were derived from high-frequency (HF) radar systems, located in the northern regions of the Maltese Islands and southern Sicily. The locations of these radar systems, depicted in Figure 1, provide a temporal snapshot of the SSC movements. The data set is in Network Common Data Form (NetCDF) format, a commonly used format for climate and meteorological data, ensuring compatibility with the Lagrangian model.

Figure 1: High-frequency radar locations.



Time-series modelling is a technique used to predict future data points by analysing the trends, cycles, and patterns in a series of data points collected over an interval of time. The main focus is on analysing historical data to uncover the underlying structure of the data, which can then be used to forecast future trends. This method is particularly powerful due to its ability to incorporate the sequence and time dependence within a data set. By examining how values are interconnected over time, time-series models can forecast future values based on the inherent temporal dynamics present in historical data. This form of predictive modelling assumes that past patterns shape future behaviours, making it an indispensable tool in various fields, ranging from weather forecasting to stock-market predictions.

While time-series modelling is a powerful tool for forecasting future data, it also has its challenges and limitations. Time-series data often exhibit seasonality and trends, which can complicate the forecasting process. Outliers, missing sequences of data, and anomalies can also significantly impact the accuracy of forecasting models, requiring careful identification and handling. The capacity of these models to integrate external influential factors and variables is also somewhat limited, often necessitating the integration of additional features for enhanced predictive accuracy. Additionally, time-series models require significantly more data for training, which can be cumbersome in situations where data is limited. These challenges highlight the importance of adopting a methodical approach to time-series modelling, emphasising the need to carefully consider the specific context and characteristics of the data being analysed when utilising time-series models for effective forecasting.

In the context of this work, SSC velocities were predicted using time-series modelling. The historical hourly data of SSC form a time series, which is inherently continuous but sampled at discrete

intervals. To address this, LSTM and GRU models are used due to their competence in handling vast amounts of sequential data and their capacity to learn complex temporal patterns. After training on past SSC data, these models can predict future values with good accuracy.

Deep learning is a subset of machine learning that uses the power of Artificial Neural Networks (ANNs) to interpret and predict data through multiple layers. Deep learning is useful because of its capacity to detect intricate patterns in various types of data.

LSTM networks are a specialised type of Recurrent Neural Networks (RNNs). They are designed to address the challenge of learning long-term dependencies and overcoming the limitations faced by traditional RNNs, notably the vanishing gradient problem. This challenge inhibits RNNs from effectively learning and retaining information over long sequences. LSTMs employ a unique architecture characterised by a system of gates, namely the input, forget, and output gates. These gates collectively decide which information should be stored, discarded, or passed through based on the relevance to the task at hand. Memory cells within LSTMs retain information over long intervals, making them adapt at managing sequences where understanding past context is crucial for future predictions. This capability is pivotal for predicting SSC velocities, as demonstrated in this project. Their ability to remember previous information for extended durations without degradation makes them ideal for capturing the underlying patterns in historical data of SSC, which is crucial for accurate prediction and subsequent debris dispersion simulations.

GRU networks are another variant of RNNs that aim to solve the vanishing gradient problem with a more simplified structure than LSTMs. GRUs simplify the LSTM model by combining the input and forget gates into a single update gate and merging the cell and

hidden states. This reduction in complexity leads to a model that is faster to train, without significantly compromising the model's ability to capture dependencies in a sequence. In the context of this project, GRUs are deployed alongside LSTMs to forecast SSC. Their efficiency and effectiveness in handling time series data render them adapt at predicting the movements of marine debris, offering a comparative perspective to the LSTM's performance.

LSTMs and GRUs distinguish themselves primarily through their structure and information processing; LSTMs offer a more detailed gating mechanism that excels in managing long-term dependencies, while GRUs provide a streamlined architecture that enables quicker training without significantly sacrificing performance. Their inherent capabilities make them exceptionally suited for time series modelling, where understanding and predicting sequential data patterns is crucial, thereby making them highly applicable to these kinds of forecasting applications.

The practice of tracking ocean surface movements in a Lagrangian framework dates back to the earliest days of oceanography. Early methods involved observing the drift of ships or the paths of specially designed floats to document sea-current movements. The Lagrangian model plays a pivotal role in environmental simulations. By offering a dynamic method to trace individual particle trajectories within fluid mediums, the model ensures the precise tracking of the particle's spatiotemporal movement. Its broad applicability spans from localised studies to global-scale systems. This is evident in its varied applications, such as tracking oil-spill diffusion, mapping floating plastic debris, and simulating jellyfish migrations, and smoke dispersion.

The Lagrangian model operates by representing particles within a fluid medium, tracking their position and properties as they move with the fluid's flow. The model calculates each particle's trajectory

by integrating the fluid's velocity field, which may vary in time and space. This approach enables the simulation of the dispersal patterns of particles, such as marine debris, by accounting for both advection and diffusion processes. Advection represents the movement of particles through the flow of a fluid. Diffusion, on the other hand, models the dispersion of particles through random motion. This is done by applying techniques such as random walks or Gaussian distributions. This inclusion of randomness enhances the realism of simulations.

Methodology

The approach taken in this research started out with the management and preprocessing of the SSC data set to ensure data integrity and accuracy. Following this, ML models were implemented that were capable of predicting SSC velocities with high precision. The final phase of the methodology involved developing a physics-based Lagrangian model that integrated the predicted SSC data. This model was used to simulate and visualise the movement and dispersion patterns of sea-surface debris around Malta and Gozo.

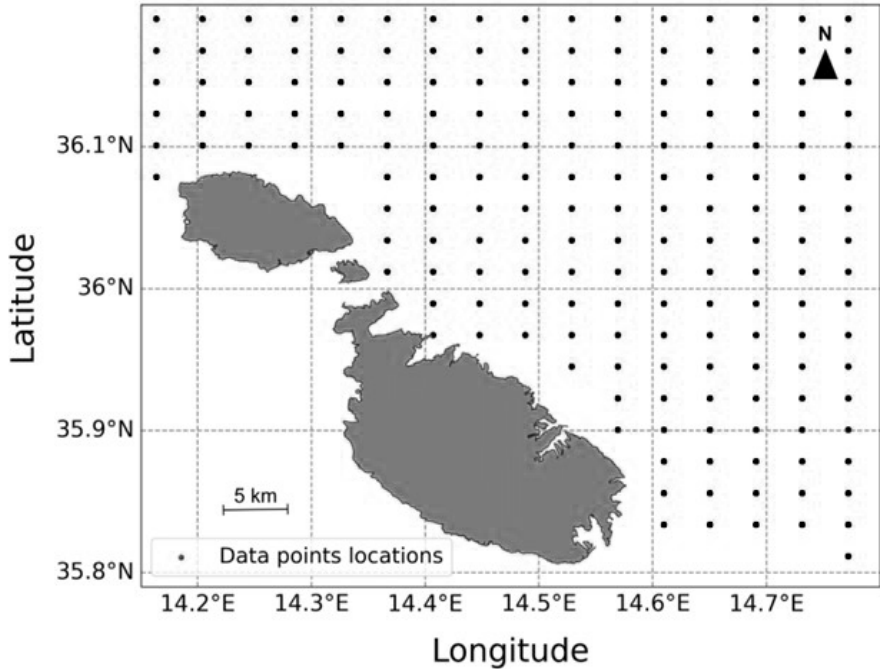
The preliminary step was to preprocess the SSC datasets. The raw SSC data was split into multiple folders and sub-folders for each day, necessitating a robust method to merge and preprocess the data without interfering with their temporal and spatial dimensionality. To address this, a utility was developed that allows for the specification of start and end dates for the merging of the SSC data. This then merged the individual files along the time dimension, creating a single data set that encompassed all relevant data across the specified interval. This merged data set was not only more manageable but also streamlined for any subsequent processes. A key feature was the preservation of the geographical boundaries and temporal aspects of the data. The data set maintained the

latitude and longitude ranges, ensuring that spatial integrity was uncompromised. Furthermore, checks were performed to ensure that the time remained consistent, preserving the temporal integrity of the data.

The initial phase of developing the ML models involved selecting appropriate models, with LSTM and GRU architectures identified as the optimal choices. This decision was informed by their demonstrated effectiveness in processing time-series data, rendering them particularly suitable for this task. Utilizing these models enables accurate predictions of marine debris dispersion around Malta and Gozo's coastal waters, effectively addressing the temporal dynamics and spatial complexities inherent to sea-surface current movements.

While the initial plan was to train a model on a year's worth of data in order to forecast SSC for the next month, the complexity and four-dimensional nature of the data led to sub-optimal predictions. Consequently, the strategy was revised to extend the data set used for training, which spanned from 25th February 2020 to 1st August 2023. The method involved individually predicting the u and v components for each pair of longitude and latitude within the defined area, which is illustrated in Figure 2. These individual predictions were subsequently merged into a single file and finally inputted into the Lagrangian simulation.

Figure 2: Locations of data points for each longitude and latitude pair.



The data did not require any normalisation, as it had already been scaled between -1 and 1 during the data-collection phase. Each coordinate pair was then processed into individual Comma-Separated Value (CSV) files. These files were systematically named and organised according to the corresponding latitude and longitude coordinate points. These CSV files served as the basis for training the ML models for every individual data-point location.

It was observed that areas closer to the coast had fewer data points (more NaNs). This lack of data near coastal regions can likely be attributed to several factors. These include radar interference from nearby land or structures, the obstruction of radar beams due to coastal terrain or buildings, and the refraction of radar waves at the coast, all contributing to distorted data collection. Efforts to solve

this issue included experiments with data interpolation and filling missing values with the mean. However, these methods yielded worse results compared to those obtained by eliminating the NaN values. Due to this, the most effective strategy proved to be the removal of NaN values.

Prior to creating the pipeline, preliminary testing was conducted on a single model to determine the most effective features and targets. Experimentation involved the integration of both u and v as features, revealing marginally improved outcomes compared to using each as a single feature, prompting a focus on using both features for the predictions. Notably, the model yielded good results when predicting a single target, but the accuracy of predictions noticeably diminished upon testing the model to predict both u and v as targets. This observation led to the decision to develop separate models for each target variable in order to maximise the accuracy of the results.

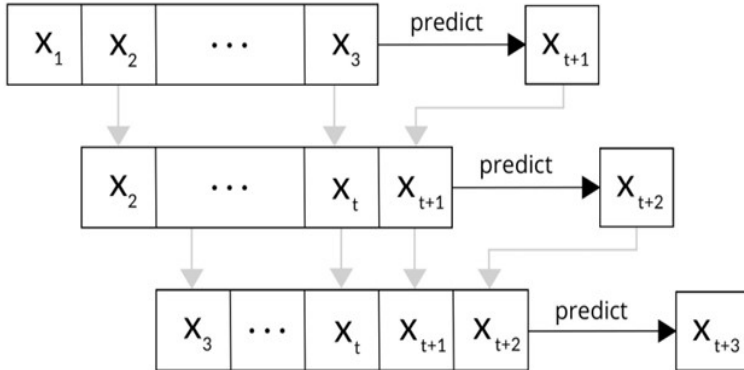
A pipeline was established that iterated through each pair of coordinates in the data set and trained a dedicated model for each individual pair. This approach made predictions across the entire area of interest, which were later utilised for the Lagrangian simulations. The u and v columns in the data files prepared earlier were extracted as input features. The data set was then divided into training, validation, and testing sets in a 70-15-15 split, respectively, a common split for ensuring a balance between adequate model training and thorough evaluation. The iterative testing of different parameter combinations revealed that a window size of 72 hours, a batch size of 64, and a sampling rate of one unit yielded the best overall results. This meant that the data was sequenced into continuous blocks of 72 hours of data as input and paired with the value immediately following these 72 hours as the target output. This step allowed the model to predict the next hour based on the preceding 72 hours of data.

Various architectures and hyperparameters were tested to determine which ones yielded the best results, including a partial grid search for hyperparameter tuning. To ensure a fair comparison, identical hyperparameters and layer configurations were applied across both the LSTM and GRU architectures. The most effective architecture involved ten hidden layers, composed of four LSTM/GRU layers, three dropout layers, and two dense layers activated via *ReLU*, followed by an additional dropout layer after each dense layer. The models were set up with a learning rate of 0.001, the *ADAM* optimiser, and the MSE loss function. Importantly, the model was reinitialised in each iteration of the loop, ensuring that each data set was trained on a fresh instance without any residual weights from previous iterations. This approach is crucial when dealing with multiple data sets to avoid any data leakage or influence from previously trained models (clean-slate training). It also helps maintain the integrity of the learning process for each distinct data set. Early stopping with a patience of 8 epochs was implemented to halt training and prevent overfitting. Model checkpoints were utilised to save the best-performing epoch automatically. After each training epoch, plots comparing training versus validation loss were generated to monitor the performance of each model. To ensure that each model was trained adequately, predictions were made on the test set and subsequently visualised by comparing actual versus predicted values. Finally, MAE, MSE, and RMSE error metrics were computed and displayed to evaluate the model's performance using the test set.

In the final phase of the ML model pipeline, a simulation mirroring a real-world scenario was made by feeding historical data spanning 72 hours to predict the subsequent 24 hours. This 24-hour prediction window was chosen since it provides a balance between short-term accuracy and computational feasibility, which is typically used for time-series forecasting in dynamic environments like SSC. The

dates of 4th August and 4th November 2023 were selected to assess the model's performance under different seasonal conditions; from here on, they are referred to as Test 1 and Test 2, respectively. Specifically, data from 1st to 3rd August 2023 were used as input to predict conditions for Test 1; data from 1st to 3rd November were used for Test 2. This setup allowed the comparison between the predictions with actual historical data from the data set. The process began with a loop to systematically extract SSC data across 72 hours for all individual coordinate pairs. Subsequently, actual observed data for the following 24-hours period on 4th August (Test 1) were extracted for comparative purposes, and both sets were saved as CSV files. Given the requirement for 72 consecutive hours of data to be able to make predictions and 24 hours for comparison, spline interpolation was utilised to address any present NaN values, ensuring the data set's completeness. Using the rolling forecasting method shown in Figure 3, predictions were generated for the subsequent 24-hour period for the individual targets u and v . It is noted that predictions based on interpolated data served as inputs for subsequent forecasts, potentially diminishing their precision. This effect was particularly noticeable in longer-term predictions, for which accuracy tended to decrease as the forecast horizon was extended, expectedly showing a decline in prediction accuracy the farther the prediction extended into the future.

Figure 3: The process of a rolling forecast.

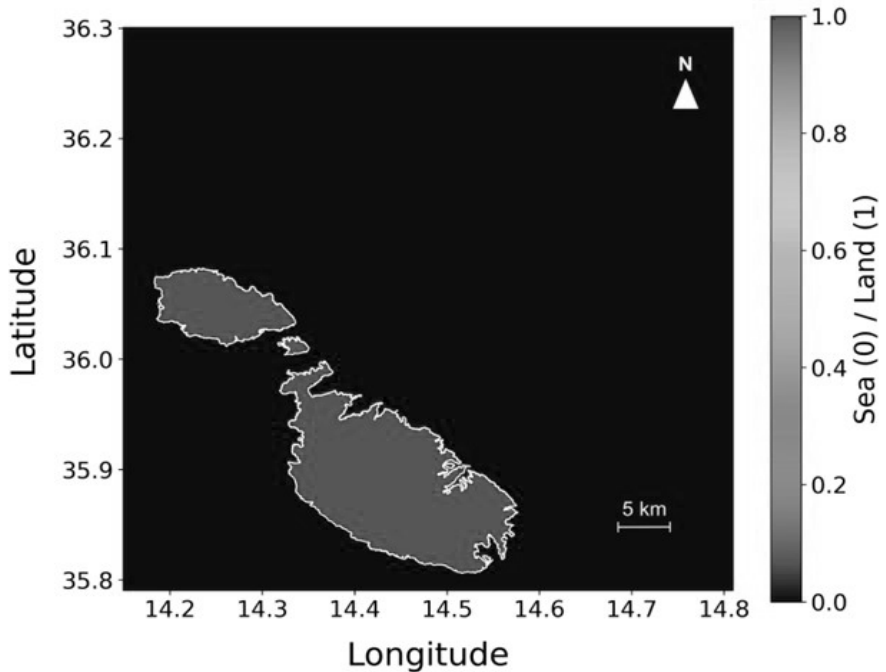


This process was repeated for all the data points, and the predictions were converted into the NetCDF format to be subsequently used in the Lagrangian model. Finally, the same error metrics were calculated to be used later for evaluation. This pipeline was repeated four times, encompassing two LSTM models and two GRU models, one for each of the u and v components, respectively. The next phase was to implement the Lagrangian physics-based model.

When it came to developing the Lagrangian model the OceanParcels³ toolkit was used. The first step was to create the land–sea mask, as can be seen in Figure 4. This effectively differentiates the land from the sea, ensuring accurate particle behaviour. The mask was saved as a NetCDF file and added within the grid boundaries to match the boundaries of the data set. These coastal boundaries define the simulation area and facilitate land–sea interactions.

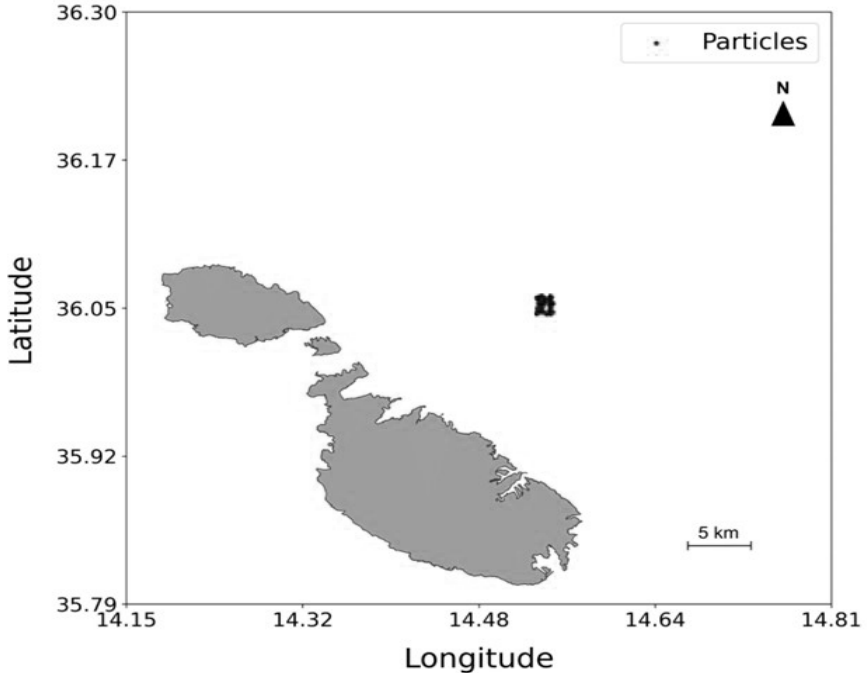
³ <https://oceanparcels.org/>.

Figure 4: Land-sea mask of Malta and Gozo.



Subsequently, a *FieldSet* was created from the SSC data set. This served as the simulation environment, defining the velocity fields that drive particle movement. Additionally, the land-sea mask was integrated into the *FieldSet*, providing necessary data for handling particles upon reaching land. As depicted in Figure 5, simulation particles were initialised near a specific geographic coordinate (36.0475° N, 14.5417° E) with random offsets to simulate a dispersed release. The particles represent the objects of interest, such as sea-surface debris, whose movements were to be simulated. Initially, the strategy involved simulating numerous randomly placed particles across the entire area; however, to enhance realism, a cluster of 50 particles was placed in close proximity. This configuration was selected to accurately represent how debris navigates marine environments, with each particle representing a cluster of debris.

Figure 5: Location of initial particles showing a cluster of debris.



Custom kernels were a critical component of the simulation, allowing specific behaviours into the simulation, thereby modelling realistic scenarios that particles may encounter. The behaviours implemented include the following:

- *CheckOutOfBounds*: which deletes particles from the simulation if they move beyond the defined boundaries. This is necessary because no data is available outside the boundary, causing particles to get stuck.
- *CheckError*: which deletes particles encountering computational errors. This ensures that the simulation proceeds without disrupted or incorrect particle data.

- *UpdateElapsedTime*: which shows how long a particle has been in the simulation. This tracks the duration of the particle within the environment.
- *UpdatePreviousPosition*: which captures the positions of particles before they move. This is useful, as it allows for saving all the previous positions of the particles.
- *ReflectOnLand*: which applies a reflection behaviour when particles encounter land, as defined by the land-sea mask. It also introduces a probabilistic component when there is a 15% chance that particles will 'beach' and be removed from the simulation, while the remaining 85% chance allows particles to be reflected back into the sea. This probabilistic distribution is justified by the geographic characteristics of the Maltese Islands, where the predominance of rocky coastlines over sandy beaches increases the likelihood of debris being deflected back into the sea, rather than getting beached.

The simulation was executed, and the resulting particle movements and dispersion patterns were visualised. These visualisations provide valuable insights into the trajectories of particles and their interactions with the environment. The time-step for the Lagrangian simulation was set to 10 minutes, capturing the continuous dynamics of particle dispersion. This interval provided a good balance between computational efficiency and accuracy. The results were saved as an animated GIF file, offering a dynamic and easily interpretable visual representation of the simulated particle dispersion over time.

Some challenges emerged during this part of the implementation. Initially, simulations revealed that particles were getting stuck at the border boundaries. This issue was traced back to the data set, which lacked data at the borders, rendering the particles unresponsive to environmental variables in these areas. To address this, the boundary

of the simulation area was slightly reduced by 0.1° in longitude and latitude. Wind was not considered in the simulation, as the spatial distribution of microplastics does not appear to be significantly affected by it. Despite this, it may still be possible that wind data may enhance the accuracy of the simulations in depicting real-life scenarios, and it may provide an interesting improvement.

The final stage of the pipeline involved integrating the ML models' predictions with the physics-based Lagrangian model to produce a 24-hour forecast simulation of sea-surface debris dispersion. This process was conducted separately for both the LSTM and GRU model predictions. The initial and most critical step involved the preprocessing and merging of the predicted u and v values as NetCDF data. In terms of the offset of the initial particles, the same random seed was used for both the LSTM and GRU simulations. This ensured a fair comparison, as the initial locations of the particles were identical for both models. Finally, the Lagrangian simulations for both the LSTM and GRU models were executed and stored. The resulting particle movements and dispersion patterns were visualised. These visualisations allow the observation of the surface-debris movement predictions while also facilitating the evaluation of the results produced via the LSTM and GRU models.

Results and Evaluation

The primary objectives were to ascertain which model (LSTM or GRU) demonstrated superior performance and to evaluate the real-world similarity of the Lagrangian simulations generated using these models' predictions. As previously noted, the framework was tested on two time periods. This was done to gauge the models' consistency and reliability under varying seasonal conditions, offering a thorough analysis of their performance across different environmental dynamics.

The pipeline was executed using August 4th (Test 1) as the selected timeframe, with the final visualization (Figure 6) displaying the surface-debris movement predictions over a 24-hour forecast simulation. Furthermore, to ensure that the procedure could generalise well, it was also run on the Test 2 timeframe for the 4th of November 2023 using the same trained models. The results for the November test are illustrated in Figure 7. These visualisations also facilitate the evaluation of the results produced by the LSTM and GRU models.

Figure 6: LSTM and GRU initial vs. final debris movement for Test 1 (4th August).

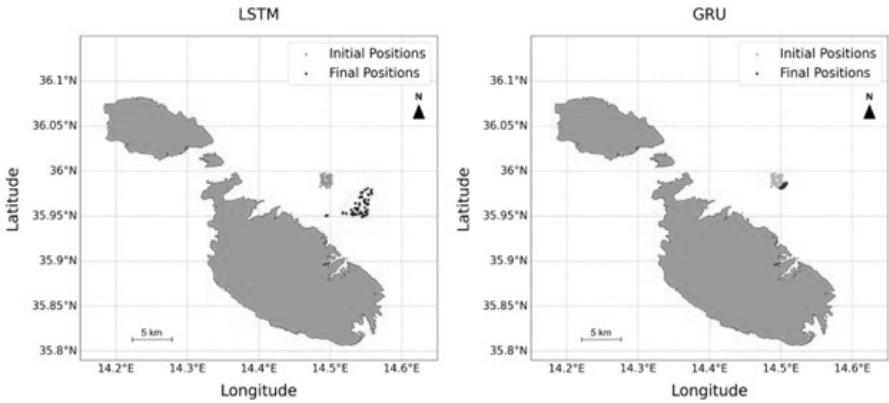
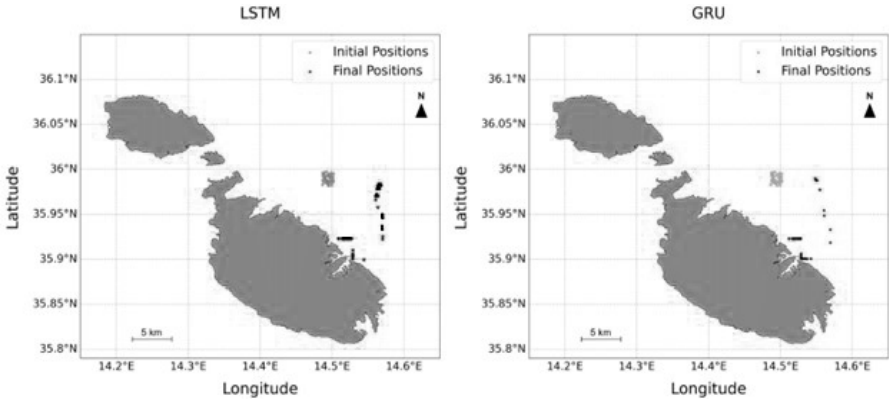


Figure 7: LSTM and LSTM initial vs. final debris movement for Test 2 (4th November)



Visual comparisons between Figures 6 and 7 indicate notable differences in the outcomes of the LSTM and GRU simulations. Specifically, the August simulations (Figure 6) revealed distinct disparities in the final particle locations between the LSTM and GRU models. Conversely, the November simulations (Figure 7) displayed a high degree of similarity. On the other hand, the November results demonstrated greater alignment between the models when compared to August. Such disparities point out the variable nature of these predictions and highlight the complex interplay of various factors that significantly impact the accuracy and consistency of the final outcomes. This variability is illustrative of the inherent challenges in modelling time-series data, for which slight variations in input or parameters can lead to markedly different predictions.

When it came to the evaluation strategy, the original plan was to evaluate the Lagrangian framework by comparing dispersion patterns with real-world drifter data. However, due to the coastal proximity of the area of interest and the general practice of deploying drifters in open waters to avoid beaching, the drifter trajectory data was not available. While this would be the ideal approach to assessing the Lagrangian simulations, this proved to be impossible due to the unavailability of drifter data. Instead, the focus shifted to the analysis of the LSTM and GRU model predictions. The mean absolute error (MAE), mean squared error (MSE), and root mean squared error (RMSE) were used to assess their predictive accuracy.

Given that this analysis included multiple distinct models for both the u and v components, the mean and standard deviation were computed for each metric to facilitate a more comprehensive evaluation of the LSTM and GRU. During the analysis, certain outliers within the results were identified. To address this, the average was also calculated using the interquartile range (IQR), focusing on the differences between the 75th and 25th percentiles for each metric

and thereby obtaining a more robust mean that excluded these outliers.

The accuracy of the models in predicting SSC velocities was assessed by comparing the predicted results against actual historical values using the MAE, MSE, and RMSE metrics. The average error metrics for the 24-hour rolling predictions from Test 1 are presented in Tables 1-4 below.

Table 1: LSTM u average error metrics for Test 1 (4th August).

Metric	Mean	Std. Dev.	IQR
MAE	0.141	0.226	0.058
MSE	0.116	0.513	0.010
RMSE	0.179	0.291	0.053

Table 2: LSTM v average error metrics for Test 1 (4th August).

Metric	Mean	Std. Dev.	IQR
MAE	0.144	0.134	0.141
MSE	0.064	0.109	0.073
RMSE	0.183	0.175	0.212

Table 3: GRU u average error metrics for Test 1 (4th August).

Metric	Mean	Std. Dev.	IQR
MAE	0.148	0.222	0.067
MSE	0.166	0.503	0.016
RMSE	0.187	0.285	0.070

Table 4: GRU v average error metrics for Test 1 (4th August).

Metric	Mean	Std. Dev.	IQR
MAE	0.145	0.138	0.149
MSE	0.066	0.112	0.066
RMSE	0.184	0.179	0.202

The analysis of these results revealed insightful differences in model performance. For the u component, the LSTM models demonstrated slightly lower MAEs and RMSEs, indicating better average accuracy and consistency, although the GRU models showed a marginally lower MSE. Conversely, for the v component, both models performed similarly, with minimal variations across all metrics, which suggests a near-equivalent capability in handling this type of prediction. A further examination of the variability through standard deviation and IQR metrics showed that the LSTM models had a lower standard deviation than the v -component predictions, suggesting more consistent performance relative to GRU. Additionally, the smaller IQR for LSTM in both components implies that its predictions were more tightly clustered around the median, indicating less variability and more reliability. While both models performed well, LSTM offered marginally better performance, particularly for the u component, establishing it as the preferable model.

The results for the 24-hour rolling predictions for Test 2 are detailed in Tables 5-8 below.

Table 5: LSTM u average error metrics for Test 2 (4th November).

Metric	Mean	Std. Dev.	IQR
MAE	1.031	2.118	0.299
MSE	14.765	40.758	0.243
RMSE	1.634	3.478	0.397

Table 6: LSTM v average error metrics for Test 2 (4th November).

Metric	Mean	Std. Dev.	IQR
MAE	2.622	5.507	0.506
MSE	97.858	253.429	0.860
RMSE	4.239	8.938	0.844

Table 7: GRU u average error metrics for Test 2 (4th November).

Metric	Mean	Std. Dev.	IQR
MAE	1.051	2.112	0.568
MSE	14.772	40.773	0.466
RMSE	1.651	3.471	0.586

Table 8: GRU v average error metrics for Test 2 (4th November).

Metric	Mean	Std. Dev.	IQR
MAE	2.653	5.502	0.537
MSE	97.980	253.623	1.144
RMSE	4.268	8.931	0.991

When it comes to the u component, both models displayed relatively high MAEs, MSEs, and RMSEs, with LSTM showing lower metrics. The high standard deviations observed for both models suggest a significant presence of outliers, indicating that some predictions were inaccurate. This is evident in the GRU u component, for which the IQR was higher, suggesting a broader spread compared to LSTM and pointing to more frequent outliers in the GRU model. In contrast, the v component exhibited considerably higher error values for both models, with GRU again having higher values across all metrics. The standard deviations and IQR values were significantly larger in the v component for both models, again reinforcing the presence of outliers and indicating that predictions for the v component were generally less accurate and more variable. Overall, the LSTM model performed better than the GRU model, particularly with the v component, as evidenced by the lower error metrics and narrower IQR. Therefore, the more consistent performance of LSTM across both tests seems to suggest that it is the better model overall.

Conclusions

In this study, an integrated system that combined ML models with a physics-based Lagrangian framework to forecast the movement and dispersion of sea-surface debris around Malta and Gozo was proposed. The results demonstrate the capability of the system to make accurate 24-hour predictions and dynamically visualise the trajectory of marine debris. Through a comparative evaluation, it was determined that the LSTM model outperformed the GRU model in predicting SSC velocities, evidenced by better performance in error metrics such as the MAE, MSE, and RMSE. These findings validate the effectiveness of the integrated approach and demonstrate its potential to enhance marine conservation efforts.

The analysis consisted of an evaluation of error metrics and geospatial behaviour, which together provided a robust evaluation of the effectiveness of the models and the corresponding practical applicability. The findings indicate that LSTM provided more consistent and reliable predictions, establishing it as the preferred model when considering the performance of both components across diverse seasonal and environmental conditions.

Throughout this study, several challenges and limitations were encountered. The primary challenge was the presence of missing data, particularly near coastal areas, which likely affected the precision of the two predictive models. Moreover, the geographical area of interest was limited, potentially constraining the broader applicability of these findings. The final limitation was the inability to empirically validate the Lagrangian model due to the absence of drifter data within the chosen area.

Integrating additional weather parameters, such as wind and wave action into the models to enhance the predictions, is left as future work. Additionally, the framework can be adapted to

various applications, including jellyfish and plankton movements, search and rescue operations, and oil-spill trajectory simulations. Further enhancements in predictive accuracy could be achieved by implementing ensemble learning methods and by integrating more sophisticated models such as transformers. Expanding the area of interest could provide a more comprehensive understanding of marine debris dynamics while also enabling the evaluation of the Lagrangian model using historical drifter data. Implementing a model specifically designed to predict and fill in missing values within the data sets could enhance the accuracy of predictions and improve visualisations. Finally, developing a front end to display future predictions with enhanced visualisations would make the research more accessible, allowing interaction with the data in real time and fostering greater engagement and understanding of the capabilities of the model and environmental implications.

Around the Maltese Islands, there is a significant issue of litter on the beaches, particularly microplastics. Some beaches experience higher levels of contamination than others, and there is uncertainty about whether the influx of plastics originates from land-based sources or the sea. Eventually, this study aims to analyse these patterns and identify the sources of beach litter, providing critical information for targeted clean-up efforts and policy-making. Additionally, the Maltese Channel is a heavily trafficked maritime route with numerous cargo ships passing through. This research can help identify potential hotspots for litter accumulation, which is crucial in the event of a spill or accident. Understanding these hotspots will enable more effective response strategies for mitigating environmental damage. Moreover, this study serves as foundational work for a jellyfish dispersion model. This future model will enable the prediction of jellyfish blooms spread and identification of potentially affected bays. Such information is vital for public safety, tourism, and marine ecosystem management.

While these applications are indeed practical and highly useful, they are beyond the scope of the current paper. Here, a model has been presented that was specifically configured and optimised for analysing floating litter, laying the groundwork for future research in these areas.

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