2 Research and Review of Literature

A critical review and analysis of the available literature pertaining to childcare and related fields is expected to provide invaluable insight into the profession. Research will be undertaken with regards to the current legislation and principles to which professional childcare settings must adhere and the means, methods and technologies available and in use to meet the expectations placed upon them.

2.1 Childcare Profession in the UK

The history of childcare in the UK spans back over a great number of years and has long been a vital service to the British public. Throughout British history individuals have been employed to raise, care for and educate children in a number of different settings. For example, during Victorian times it was not uncommon for those families wealthy enough to employ a nanny to care for the children [2]. It was also not uncommon that those families wealthy enough were also able to send their children to local privately funded schools given that no publicly available system of education was made available in the UK until the 19th century [3]. For the working class of Britain however, schools and childcare were an unthinkable concept as children were instead required to join the workforce and bring home a wage. In 1821, during the height of the Industrial Revolution, 49% of the UK's workforce was made up of individuals under the age of twenty with children as young as five working in agriculture and as chimney sweeps [4]. Entering the 19th century, the role of children (particularly in less wealthy families) was to act as a *'little adult'* and to perform the tasks expected of an adult. This attitude slowly shifted throughout the century. Throughout the 19th century a number of initiatives sprung up signalling this change in cultural attitude towards children:

- Factory Act 1833 – In 1833, the Government passed the Factory Act which gave young children some basic rights. These rights included the protection that factories should not employ children under the age of nine, that those child employees over nine years old were limited on the number of hours they could work in a day and significantly that child workers would receive two hours of schooling each day. [5]
- Industrial Schools Act 1857 – In 1857, the Government gave magistrates the power to sentence criminal and vagrant children to a period of time in industrial school. The intention of the industrial schools was to remove children from vulnerable situations where they be drawn into crime and instead give them education and training in a particular industrial skill. [6-7].
- Education Act 1870 – Although religious privately funded and industrial schools were in operation, for the few it wasn't until 1870 that the inaugural piece of legislation on national education was passed. The Education Act 1870 stands as the first recognised commitment by the UK Government of a national provision for education for children.
- National Society for the Prevention of Cruelty to Children (NSPCC) 1884 – After being founded in 1884 [8] the NSPCC played an integral role in campaigning for protection of children with their first major breakthrough in 1889 when the first ever UK law protecting children from abuse was passed [9].

These initiatives are just some of the key examples and milestones in the changing cultural perception of the role of children through the 19th century. Of course, the misuse and poor treatment of children did not end overnight but what followed for many years was a continued improvement in the cultural perception and the protection of children. Another major milestone in this cultural shift was the acceptance of the Declaration of the Rights of the Child by the League of Nations (including the UK) in 1924 following the World War One [10].

2.2 Early Years Education

During the 19th and 20th centuries with much of Europe undergoing similar transformation it was from the continent that some of the most influential pioneers of childcare and early years education emerged. Possibly the most influential among these was German philosopher and educator Friedrich Fröebel. Having spent a vast number of years as an educator and advocate for early years learning, Fröebel is most famous for coining the term *'kindergarten'* (German for *'children's garden'*) in 1840, a name he had given to his institution opened in Blakenburg in 1837 [11]. Fröebel placed a great deal of importance on the naming of his institution rejecting suggestions such as *'infant school'* stating that his kindergarten would a be place where children were not schooled but freely developed. By supplying a range of selected toys and apparatus to the kindergarten, Fröebel established a learning through play approach to developing children [12].

Closer to home, it was the somewhat controversial Welshman Robert Owen who established the UK's first infant's school in New Lanark in 1816. The controversy regarding Owen related to how he profited greatly from the industrial revolution which exploited child labour [13]. Although providing a means of education to children, Owen claimed that children *"will always amuse each other without useless childish toys"* [14] - a belief fundamentally different to that of Fröebel who encouraged learning through play and the freedom to imagine. Fröebel's principles of freedom and guidance continue to form the basis of many childcare settings in the modern-day.

In the years that followed World War One, with less children in the workforce and the start of World War Two in 1939, an increase in childcare provision was needed. This provision of childcare across the UK was necessary to account for the absence of fathers serving in the Armed Forces and mothers who had taken on employment to support their family and fill the gap left by those men fighting the war. It was during World War Two that the Education Act 1944 stated that local education authorities should provide provision of nursery schools for children under five years [15] marking a significant development in childcare and early years education. Following the war, the provision for childcare continued to grow but not necessarily at a rate that matched the demand. Following the war many women who had taken on employment chose to continue in their roles [16].

2.3 Cultural Shift

2.3.1 Changing role of women

World War Two brought an inevitable widespread change to the UK workforce and the role of women in society. With the British Army increasing in size from one million men in September 1939 to 3.5 million men by the end of the war, it was unavoidable that women would be so heavily relied upon to fill the gaps left by men [17]. With the war taking a major

toll on Britain, women found themselves becoming a vital component in success. From 1941 women were called to fill roles as engineers, mechanics and driving emergency vehicles and by mid-1943 almost 90% of single women and 80% of married women were employed in factories, agriculture or in the Armed Forces. Women accounted for over 640,000 positions, among these included the then Princess Elizabeth [18]. Following the war, as men returned (though not as many that left) many women were forced to leave their job roles. Within a year of the war ending over a million women had left their jobs [19]. Women in employment had been expected to return to the 1930's gender role of looking after the home and *"servicing a male breadwinner as his dependent"* but what was clear is that for many women the war had given them an opportunity to understand their worth in the workplace and that *"the place of women after the war was not exactly what it had been in 1939"* [20].

In an American study (where the attitude towards the role of women was very similar to that of Britain) found that in 1900 only 25% of women worked outside of their home. Following a sharp increase of women in the workforce during World War Two and rapid decline following the war the percentage of women in work grew from 30% in 1950 to 50% in 1980 [21]. In the UK, the Office for National Statistics (ONS) cites World War One as an initial opportunity for women to move into industry and that continued change in attitudes, particularly around the 1960s, played a large part in the increase from five million women in the workforce in 1900 to thirteen million by the year 2000. This increase saw women make up 46% of the workforce by the year 2000 [22]. Alongside the cultural shift of attitude towards the role of women in society was a number of other factors that influenced the positive incline in women in the workforce. Over a number of years, manufacture and heavy industry found itself becoming more automated and less reliant upon physical exertion making them more accessible industries for women. Another major component was the introduction of the aforementioned Education Act 1944. In 1922 female students made up just 23% of the 10,000 degrees obtained in the UK; by 1993 female students represented 45% of degree recipients [22]. This incline in female degree recipients can largely be attributed to the Education Act 1944 that afforded more girls access to education and inevitably led to the greater representation of females receiving degrees. With a greater percentage of educated females, it is natural that more women would also desire a professional career than in previous generations. In addition, the Education Act 1944 also afforded women more free time than they had previously been used to owing to children attending formal education.

Figure 1 shows the positive incline of female representation in the UK workforce between 1971 and 2017:
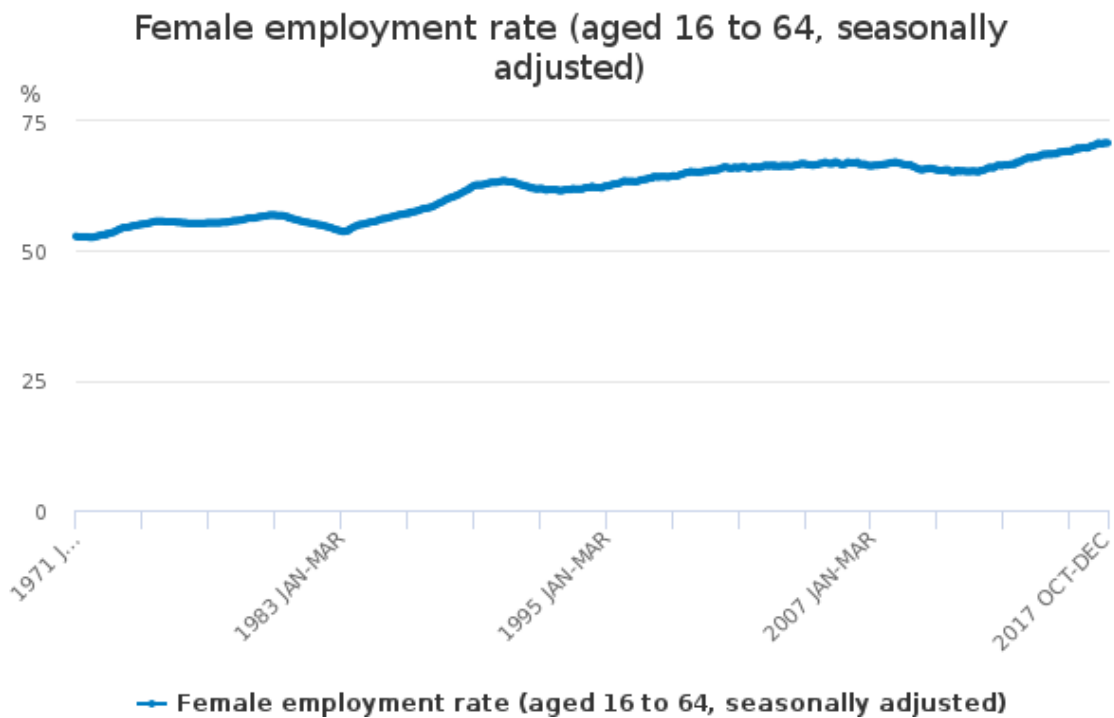
Female employment rate (aged 16 to 64, seasonally adjusted)

Figure 1 – Female employment rate graph. [23]

2.3.2 Changing role of men
While the 20th century as a whole brought about a dramatic change for women across the UK it was the later decades that saw a change in the cultural attitude towards the role of men. According to a British Social Attitudes survey conducted in 1984, 49% of those questioned agreed with the statement *"a man's job is to earn money; a woman's job is to look after the home and family"*. When the same statement was proposed in 2012 the findings showed a significantly lower rate of people held this view with only 13% agreeing with the statement [24]. With an increased female representation in the workforce this has also been a factor on the changing role of men and fathers. In working families, maternal breadwinning is on the rise with 33% of working mothers earning at least half of the household income [33]. Studies have found that in two-parent families where the mother is employed, weekly paternal engagement with children is substantially higher than in families with unemployed mothers. This suggestion is challenged though by the fact that working mothers spend less time with their children meaning fathers are only proportionally more engaged [25]. Although in most families the amount of time fathers spend playing with their children falls short of maternal engagement, studies suggest that a child's play with a father is generally more stimulating and emotionally arousing due to a more boisterous nature and may make their time with children more influential [25]. Though the general perception is that mothers are more affectionate than fathers a meta-analysis of 172 studies conducted by psychologists Lytton and Romney found little or no difference in seven areas of parenting including *"warmth, nurturance, responsiveness, encouragement of dependence, restrictiveness, low encouragement of independence, and disciplinary strictness"* [26-27].

2.3.3 Family roles

In keeping with the apparent change of public attitude towards the role of parents, in 2015 the UK Government launched its Shared Parental Leave (SPL) initiative. The SPL initiative affords eligible parents the opportunity to share leave from employment between both mother and father equally [28] rather than the two week limitation imposed on fathers prior to its inception in 2015. One year following the initiative's launch the UK Government commissioned a survey that found if money were no issue then 53% felt that the responsibility of looking after children should be shared equally [29]:

Question Two
Who do you think should have the main responsibility for looking after the children in the household, assuming money isn't an issue?

- It should be shared equally
- The mother
- Each set of parents should have the right to choose according to their circumstances
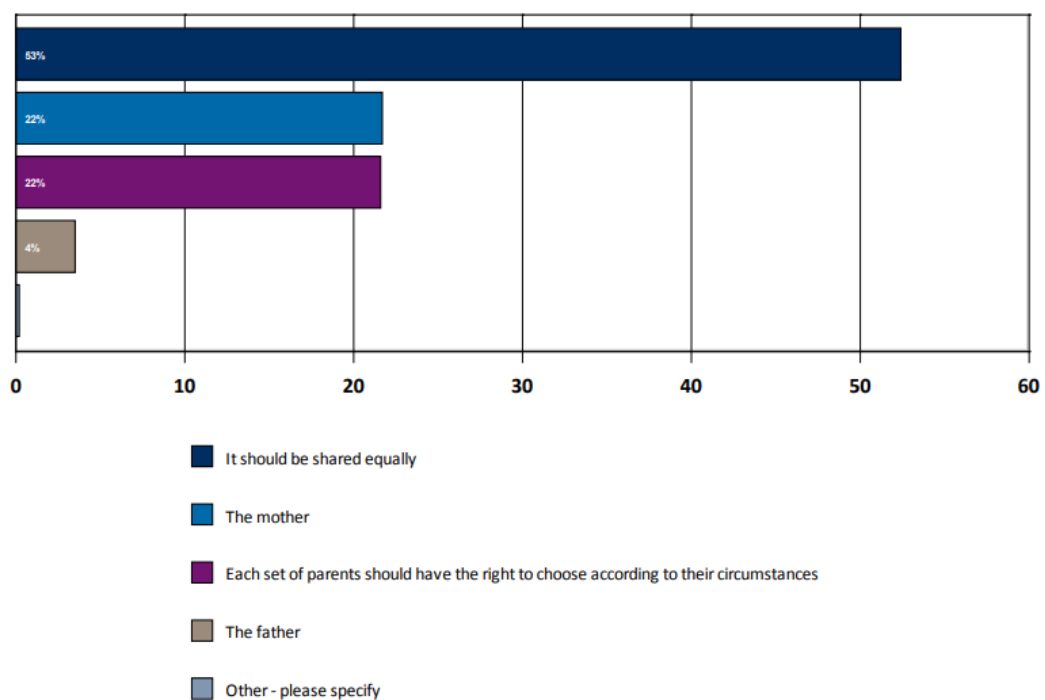- The father
- Other - please specify

Figure 2 – UK Government SPL Survey. [29]

Although the majority of those surveyed felt that responsibility should be shared this did not reflect in the statistics of how SPL was actually allocated between parents. Of those fathers questioned, 74.8% said that if SPL had been available when they had children they would have considered it and an even greater 85.9% suggest they will consider it for future. The staggering reality though is that just 1% of men are applying for SPL according to a survey commissioned by My Family Care and the Women's Business Council [30].

Question Seven Cross Tabulation With Gender

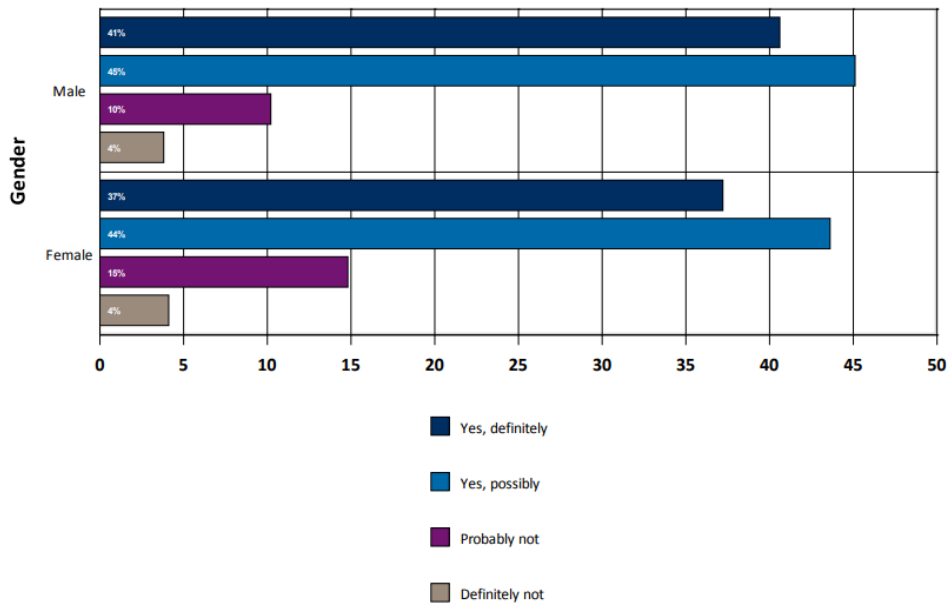Do you think you'd consider sharing parental leave with your partner if you had a child in the future?

Figure 3 – UK Government SPL Survey. [29]

The astonishingly low uptake of SPL can be attributed to a number of factors though in the main it pertains to financial insecurity and the possibility of a negative effect on the father's career. Of those fathers questioned, 38% state they would be financially worse off for taking shared parental leave.

If you took shared parental leave to look after a baby, what would your main concerns be? – *Asked to males only*
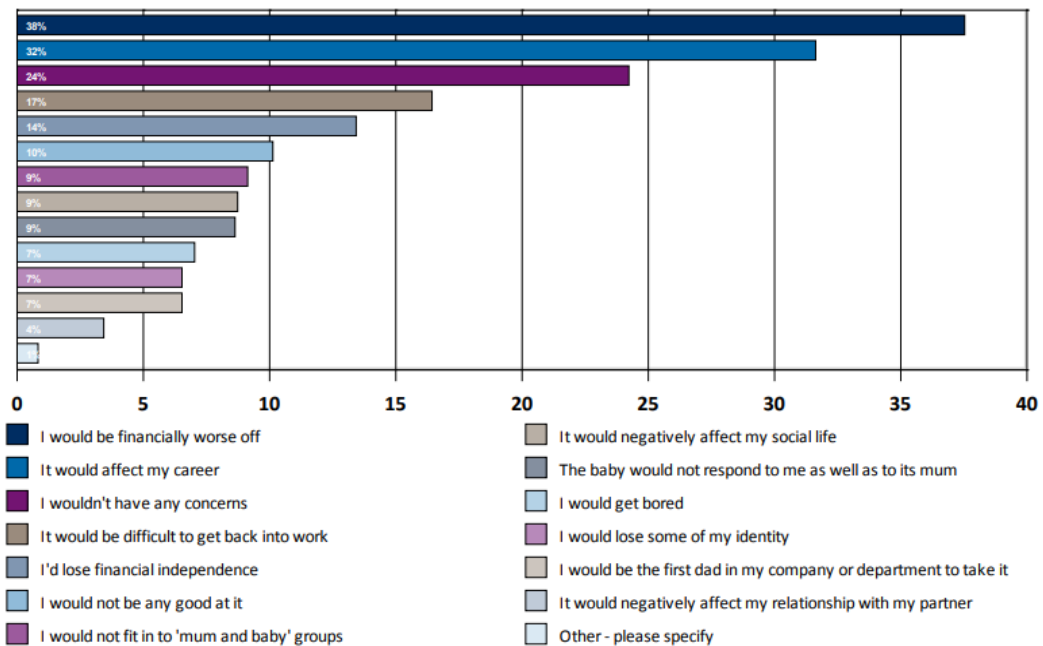
Figure 4 – UK Government SPL Survey. [29]

In addition to the financial and practical implications of fathers taking SPL there also seems to be resonating values of old. When asked why mothers should have the main responsibility of looking after a baby, 69% of participants agreed that mothers make more natural parents. When the same questioned was reversed only 3% of participants felt fathers make more natural parents.

While the statistics analysed seem to tell a rather mixed story, the truth is that they only focus on a rather specific issue. The introduction of SPL gives a clear indication that public attitudes are challenging the stereotypically assumed roles of mothers and fathers in the family. Unfortunately, it seems that although SPL is an example of a well-intended initiative many families are unable to utilise it as it would have a negative impact on their household financially. In two-parent families, 48% of parents surveyed both work full-time with 72% claiming they use evenings and weekends to catch-up on work. In addition, 47% of those questioned said that over the last two years it has become more financially challenging to raise a family [31].

In 21st century Britain there is no such thing as a typical family unit [32]. With maternal breadwinning being true for 33% of families [33], 46% of the UK workforce being made up of women [22] and the university gender gap being greater than ever with 30,000 more females attending university in this academic year than males [34] it is inevitable that the traditional view of gender roles is being challenged more than ever before [26]. As women continue to excel both academically and professionally and men continue to assume the role as a family's primary breadwinner the unavoidable outcome is that childcare as a profession will be required to play an integral part of supporting parents to continue working.

2.4 Modern-day Childcare

Having considered key contributory factors, with a particular focus on the last 70 years, it is clear that childcare as a profession is a necessity in modern-day Britain. In Wales alone the childcare profession employs over 17,000 people and it is believed that by providing this service parents go on to generate an estimated £1.2 billion in annual income [35]. Welsh Government consider childcare to be a growing profession and recognise the role it plays in supporting economic growth and reduction of poverty in the country. This growth in childcare is exemplified by the incline of available childcare places from 76,000 in 2012 to 84,000 in 2017 [35].

The childcare profession in Wales operates in a number of formats giving parents the option to find a solution that best fits the needs of their family:
- Childminders – Registered childminders care for children in their own home and are often smaller in number than other settings.
- Day care (Sessional) – Sessional day care settings usually operate AM and PM sessions which is more suited to parents who may only require the service for a specific part of the day.
- Day care (Full days) – Full day settings provide care for the whole day. For example, 8am - 5pm.

- Out of School – These settings provide care for children of school age before or following the school day.
- Open Access Play Provision – Play provision can be located in a variety of settings and may or may not have a premises. It is staff supervised, but child-led play activities where children have a wide range of freedom to play as they wish within safety guidelines.
- Crèche – Crèche is considered occasional day care for children up to 12 years old on non-domestic premises.

[36]

In December 2016, CSSIW had 4,012 registered childcare providers. Figure 5 depicts the proportional representation of these childcare settings according to type:
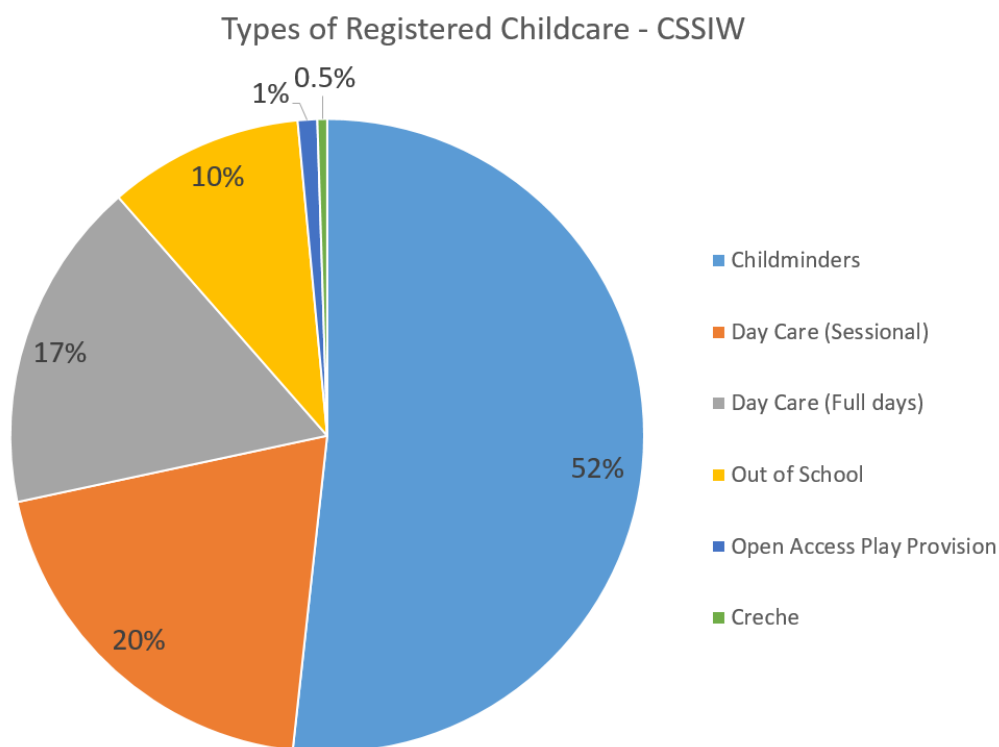

Figure 5 – Childcare Settings Chart. [35]

Registered childminders account for over half of all registered childcare providers in Wales and are significantly larger in representation than other types of childcare setting.

Figure 6 depicts the ownership of registered childcare settings in Wales:
- Private – Private childcare settings are owned privately and operate by charging parents a rate to care for children. This rate can be defined by hours, sessions, days or however the setting sees fit.
- Public – Public childcare settings are operated by local government and authorities. These settings are usually non-domestic and offer childcare to some of the most disadvantaged communities in Wales [37].

- Voluntary – These account for the majority of sessional care providers such as play groups.
- Other – Data is not provided for the *'Other'* 5%.
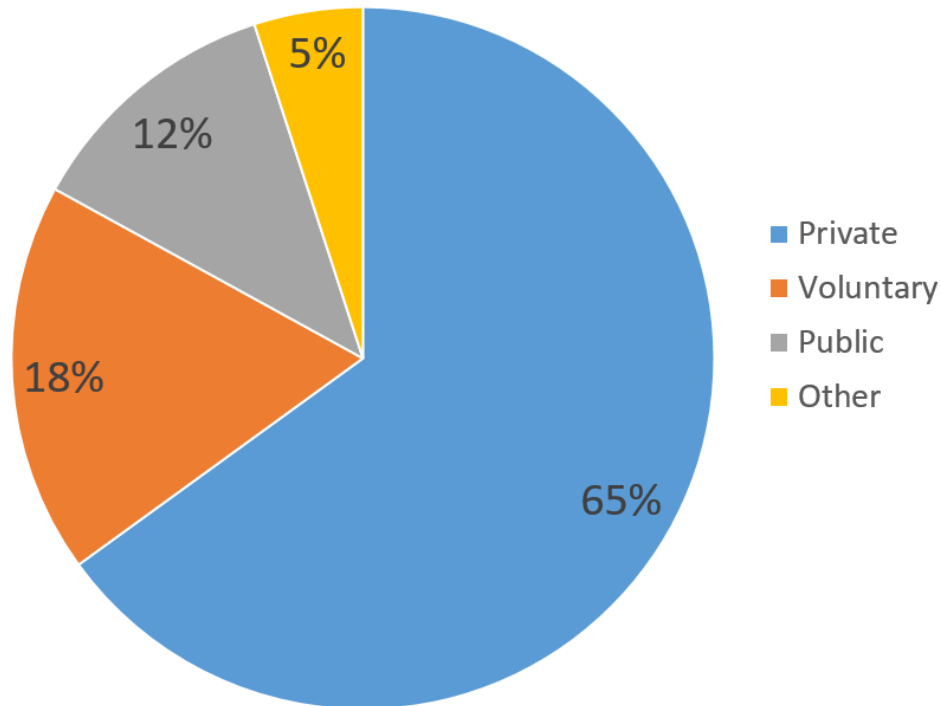
Providers of Childcare

Figure 6 – Childcare Settings Chart. [35]

2.4.1 Modern-day Demand

Childcare as a profession, according to Welsh Government is growing but the question now is whether or there are enough childcare places available to meet demand. According to the Childcare Capacity report issued by Welsh Government there are approximately 175,000 children up to the age of four living in Wales and a total of just less than 80,000 childcare places available [38]. Welsh Government recognise the need for increased provision in the Childcare Capacity report stating *"the childcare sector in Wales has been given priority sector status and funding has been announced for business support services for childcare providers"* [39]. Welsh Government are also introducing a scheme where working parents of three and four year olds are provided thirty hours of free childcare per week for forty-eight weeks of the year [40]. The major problem faced by Welsh Government is that the Childcare Capacity report indicates that there are 46,000 children eligible for full day places yet only 45,000 spaces are available [38]. It is highly unlikely that all of those eligible would take up the offer but does give an indication of the high demand for professional childcare services in Wales with some areas of Wales having no professional childcare availability whatsoever.

Welsh Government's proposal to offer thirty hours of free childcare to working parents is being heralded as a welcome relief. In focus groups and meetings with the public Welsh Government recognise that for many families large portions of income were being spent on

childcare [41]. According to Family and Childcare Trust's Childcare Survey 2017, parents working part-time and requiring twenty-five hours of childcare with a private childminder can expect to pay an average of £101.03 and those requiring fifty hours paying an average of £193.84 [39]. Put into the context, the median gross weekly earnings in Wales amount to £498.40, the lowest in the UK which amounts to a take-home wage of £401.98 after tax and National Insurance [42]. Based on the median gross weekly earnings above, the average childcare cost would demand a sizeable 48% of the earner's weekly wage. Alternative childcare provisions and family support have been considered (See Appendix A).

2.5 Benefits and Drawbacks of Childcare

Having considered and analysed a number of key areas relating to childcare, the most important factor yet to be considered is the impact on the child. The impact of childcare on children is a difficult area to study and analyse in quantitative measures owing to the fact that childcare settings differ so greatly. What is generally agreed though is that both positive and negative impacts on a child's behaviour and development are influenced greatly by the quality of care the child receives [43]. The initial theory by many scholars is that non-parental childcare could be risky for children and that separation from parents can have negative psychological and behavioural impact but research has gone a great way to debunk this misconception. The Encyclopaedia on Early Childhood Development who conducted research into the field found that good quality childcare benefits almost all children who enjoy positive relationships with childcare providers [44]. It was found that positive childcare experiences help develop a child cognitively and behaviourally by opening extended social worlds to children and that relationships with parents are not harmed by childcare experiences [44]. In addition, studies found that ideal environments combine quality, affordability and accessibility and that a setting offering these to a high standard are critical for long-term benefits [45]. Having considered a number of studies and resources it is clear that the impact of childcare hinders on the quality of care provided in much the same way that children are influenced by the quality of parenting they receive. Separation from parents has no negative impact where children are cared for in a high quality setting and is positively associated with cognitive development [46].

2.6 UK Legislation

Given the very nature of its service, it is absolutely necessary that the childminding profession is regulated by a governing body. In Wales, CSSIW all childcare professionals must register with and adhere to the standards of CSSIW in accordance with The Regulation of Child Minding and Day Care (Wales) Order 2016 [47]. Focusing on professional childminders, it is a requirement to register with CSSIW where an individual is paid to care for one of more children under the age of twelve in their own home [48]. In their most recent annual report, CSSIW indicate that there are currently 2,340 registered childminders in Wales offering a total of 16,531 childcare places [49]. These professional childminders must comply with the National Minimum Standards for Regulated Childcare provided by CSSIW. The National Minimum Standards consists of twenty-five standards covering areas such as record keeping, quality of care and the management of services. To ensure compliance with these standards, CSSIW conduct full and focused inspections of childcare settings [50].

The following is a summarised list of the National Minimum Standards for Regulated Childcare provided by CSSIW:

Information on Service
Parents should be provided with all of information they may require to make an informed decision. This should include information about the business including a Statement of Purpose.

1. Information
2. The Contract

Planning for individual needs and preferences
The individual needs and requirements of a child should be assessed, recorded and accounted for in the quality of care delivered by the childminding professional.

3. Assessment
4. Meeting individual needs
5. Records

Empowering service users, encouraging lifestyle choices
Parents must be kept involved and informed about the activities, achievements and noted progress and development of their child.

6. Working in partnership with parents
7. Opportunities for play and learning

Quality of care
Children should feel secure, happy and comfortable with their carers and in the childcare setting. The rights of children must be upheld and respected.

8. Nurture and well-being
9. Behaviour
10. Healthcare
11. Medication
12. Food and drink

Staffing
Suitably trained, qualified and experienced individuals should be employed in childcare settings to ensure that the needs of children are fully met.

13. Suitable persons

Conduct and management of the services
Both parents and carers benefit from a well-organised childcare setting. Staff to child ratios should remain in accordance with best practice guidelines. It is also imperative that the business operates sound financial procedures to offer a consistent high quality service.

14. Organisation
15. Staffing ratios
16. Equal opportunities
17. Financial procedures
18. Quality assurance

Complaints, protection and notifications of significant events
In the event that a parent is compelled to make a formal complaint they should feel confident that their complaint will be listened to and taken seriously. Children are respected and protected and parents are informed of anything that may impact their care.

19. Complaints
20. Child protection
21. Notifications of significant events

The physical environment
The environment in which children are cared for should be safe, secure and suitable for the purpose and activities of children. Childminders must adhere to additional relevant legislation such as the Health and Safety at Work Act 1974.

22. Environment
23. Equipment
24. Safety
[36]

Of the National Minimum Standards, standards five and six make specific reference to the importance and necessity of record keeping and communication. Standard five highlights the key recordings that must be kept which includes:
- Business Contact Information.
- Records of child accidents.
- Records of first aid.
- Records of children's special dietary requirements / allergies / medical information.
- Documentation showing the procedures in the event of a child being lost or not collected.

In addition, standard five dictates that parents and CSSIW be allowed *"access as appropriate to a full range of records maintained by the registered person for the smooth running of the setting"* [36] to ensure that lines of communication are open and accessible.

Furthermore, standard six which is entitled *"working in partnership with parents"* requires that *"parents are kept fully involved in and informed about their child's activities, achievement and progress"* [36]. While the regulations do not specify that a daily recording must be produced for each child, by doing so Little Flowers ensure that they are honouring their own principal of effective communication with parents, that they are meeting standard six of the regulations and also generating official recordings that can be referenced at a later date should they be required. Keeping regular recordings of the activities and progress of the children in their care is an effective means of involving parents in the development of

future care for their children and bridges the gap between care in the home and care in the childminding setting.

In addition to the childcare focused policies and law, Little Flowers must also adhere to further common workplace laws identified in (See Appendix C).

2.6.1 Additional legal considerations

The primary goal of this project is to digitise a number of documents and businesses processes for Little Flowers. Subsequently, it is of the utmost importance that all investigation and development is done so well-within legal and ethical boundaries. The development of this project will at no point require the sharing of actual data or information relating to a minor nor will contact be appropriate with a minor or parent of a minor either directly or indirectly. All documentation provided by Little Flowers will be blank, completed with fictitious data or have all personally identifiable information and media redacted. These safeguards will ensure that the proposal and project do not infringe upon or contravene with the Data Protection Act 1998 [51].

In the design, development and deployment phases of this project particular consideration will be given to principle seven of the Data Protection Act that states *"appropriate technical and organisational measures shall be taken against unauthorised or unlawful processing of personal data and against accidental loss or destruction of, or damage to, personal data."* [52].

2.7 Available Tools

To gain a wider understanding of currently adopted childcare record keeping tools and to identify a potential solution for Little Flowers time has been taken to contact local childcare settings. As expected, each setting was in full compliance with CSSIW's standards but seemed to manage the responsibility of record keeping with varying approaches.

2.7.1 Nursery Genie

A senior nursery nurse at Treetops Day Nursery stated that they currently use a combination of both physical and digital recording processes. Staff at the nursery use a software package called Nursery Genie [53]. It was explained that daily diaries for children were completed by hand to make them more personal to each child. Nursery Genie is also adopted by Mes Enfants in Swansea and Pobl Bach in Carmarthenshire.

Nursery Genie is developed by software company Care Software based in Swansea. Nursery Genie boasts a number of features including checking in and checking out, meal time records, accident recording and more. Having spoken to a representative of the Nursery Genie product I was informed that Nursery Genie only works on Windows PCs and tablets and was developed in the C# programming language. The application itself is locally installed meaning the user must be on the device it is installed on to use it, but the data can be accessed remotely. The problem here is that should the device become non-operational or Little Flowers desire to complete recordings from a separate device they would not be able to do so.

Nursery Genie is designed for clients operating a nursery environment where a larger number of children are cared for. To access many of the features that Nursery Genie boasts requires the client to subscribe to the premium monthly contract. While the cost of a premium contract may be an acceptable in a larger scheme, it would be too significant an outgoing for Little Flowers. Nursery Genie is a feature rich solution with an intuitive user interface but unfortunately its limitation to a single device and relatively high monthly cost make it unsuitable for Little Flowers.

Table 1 - Advantages and disadvantages of Nursery Genie

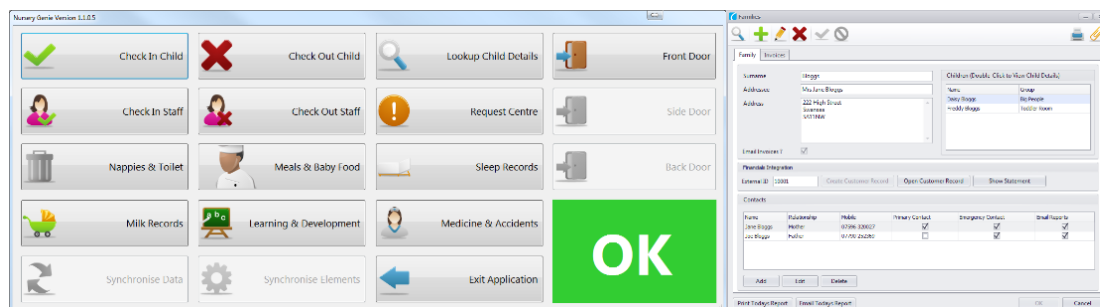| Nursery Genie	
Advantages	**Disadvantages**
UI is user friendly and intuitive.	NG is not available outside of a Windows environment.
Email integration allowing reports and information to be sent digitally to parents.	Parents unable to view previous recording/information relating to their child.
Integration with other tools specifically invoicing software such as ClearBooks, QuickBooks and Sage.	Pricing only allows for touch screen/tablet licenses on the premium package (£180/month).

Figure 7 – Nursery Genie Screenshots.

2.7.2 MyMontessoriChild
Another similar childcare establishment in terms of size to Treetops is Montessori. Montessori take a digital approach to managing recordings and correspondence through a web-application called MyMontessoriChild (MMC) [54]. Staff and parents/carers are able to log into this web-application to create or view recordings.

MMC is a bespoke application developed for sole use by Montessori staff within a Montessori setting. Unfortunately, the MMC website provides little in the way of detail about the application itself. The website indicates that the app is able to record teachers' observations with a view to developing teaching plans and providing reports. The website also suggests that the MMC system is *"as secure as online banking".* A post on popular internet forum MumsNet made by Lucy Morrison, a partner of MMC, assured parents that MMC places a strong focus on security. Morrison states that the application utilises:
- Two factor authentication.
- Data encryption.
- System activity logging and monitoring.
- Data backups on secure servers.

While some of these terms may not be commonly understood by the average user, it does indicate that MMC are thorough with regards to the security measures they enforce and towards data protection as a whole.

As stated, MMC is a bespoke application and is available only to Montessori placements. This of course makes it an unsuitable solution for Little Flowers.

Table 2 - Advantages and disadvantages of MyMontessoriChild

MyMontessoriChild	
Advantages	**Disadvantages**
High priority on application security and data protection.	Little information provided on the website to prospective placements or parents.
Bespoke system for Montessori placements. As a result those familiar with Montessori are likely to feel quickly comfortable with the solution.	Website and all information is contained in a single image. This makes it impossible for users with screen readers to access.

2.7.3 iChildCare

The final digital solution evaluated is iChildCare. Interestingly, iChildCare was also developed in Swansea like Nursery Genie. In comparison to Nursery Genie, iChildCare has adopted a different approach in a number of key areas most notably the application's implementation. iChildCare utilises the server-side scripting language PHP to create a web-application that is accessed through an internet browser. As a result of this method of implementation, iChildCare instantly alleviates the limitation of using the application on a single device meaning it can be accessed from a range of devices from any internet connected location.

iChildCare offers a number of features including daily diary recording, document and policy management, accident and incident recording, child attendance calendar and more. It is a highly functional solution and with a monthly cost of £9.99 is a more feasible solution when compared to the likes of Nursery Genie. The level of detail provided about the solution on the website and accompanying screenshots will reassure prospective customers by giving them an opportunity to appreciate how the application is likely to work.

iChildCare is a solution that meets a number of the needs of Little Flowers. The primary concern however is that iChildCare is a third party application that runs entirely separately from Little Flowers and their website. This raises difficult questions with regards to data protection and what would happen in the event of iChildCare becoming non-operational or going out of business.

Table 3 - Advantages and disadvantages of iChildCare.

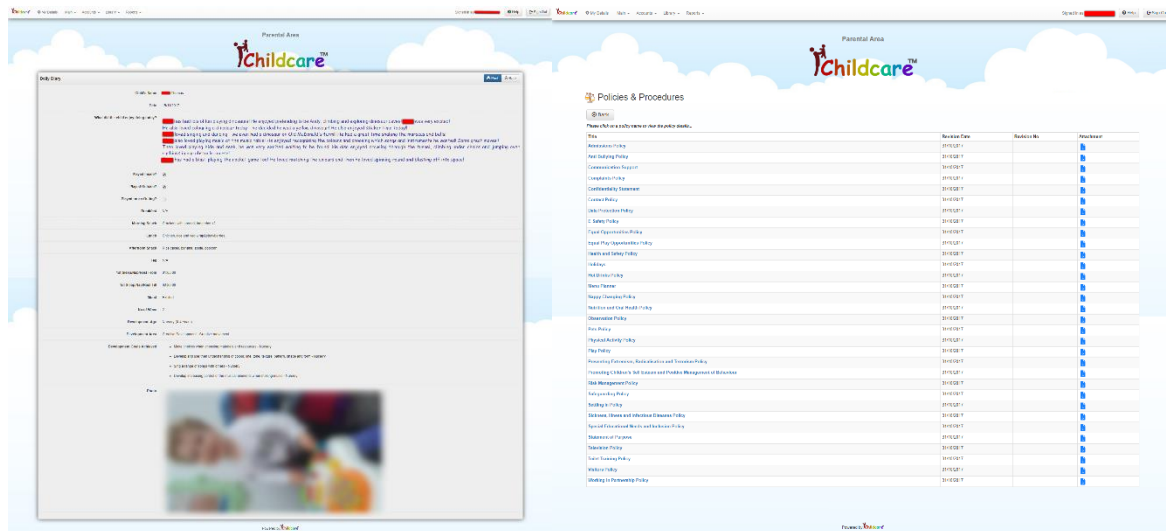| iChildCare	
Advantages	**Disadvantages**
Browser based web-application available on all devices.	The login screen for staff and clients are almost identical. This can cause confusion for visitors.
Cost-effective solution in comparison to alternatives. No fixed contract lengths.	iChildCare does not integrate with existing websites. Users must operate it through the iChildCare domain.

Figure 8 - Daily diary generated by iChildCare (NB Identifiable information has been redacted) and Little Flower's policies available online.

2.7.4 Independent Childminder

Finally, to gain insight into a range of childcare settings the practices of a newly established childminding service in Swansea were considered. This childminding service currently provides care to just three children having only recently completed the CCSIW registration process. At present all records currently exist in a paper-based format and will continue to do so for the foreseeable future with the exception of invoices that are calculated using Microsoft Excel and distributed digitally via email. Given the size and youth of the business it is understandable that they are not yet prepared to take the financial risk of implementing a digital system without first gaining a steady client base.

Conclusion

This investigation into the available tools and current practices of how professional childcare settings adhere to the regulations set out by CSSIW clearly indicates that there is no industry standard means of producing and maintaining records. Each of the childcare settings analysed adopted an approach that can either be considered a manual paper-based approach or a digital approach. Smaller childcare settings, such as childminders, appear more likely to adopt a paper-based approach as opposed to larger settings such as nurseries that utilise a digital solution.

2.8 Potential Methods and Technologies

To produce a solution that is effective and meets the requirements of Little Flowers it is important to first consider the range of methods and technologies currently available to design, develop and produce the solution they require.

2.8.1 Locally installed software

The first consideration for development is a locally installed software solution, often referred to as a thick client. A thick client is software that is installed on a single device that may require periodic connection to an external network for updates and acquiring resources. A thick client is often characterised by its requirement of such computer resources as hard disk storage, RAM and CPU [55]. Thick clients are software solutions installed to a computer where most functionality is not dependent on a connection to a network or server.

.NET Framework

The .NET framework is a programming and software development framework that allows software developers and engineers to produce applications suitable for the Windows environment. The .NET framework provides an extensive class library that provides developers with a wealth of code that allows them to create applications that can easily utilise the resources of the machine on which it is installed [56]. The .NET framework allows developers to write code in programming languages such as Visual Basic, C++ and C#.

According to StatCounter, Microsoft's Windows operating systems currently hold an incredible 82.56% market share of desktop operating systems worldwide [57]. Little Flowers currently use a Microsoft Surface laptop operating on Windows 10 which would make a solution built using the .NET framework suitable for their setting at present.

Java

An alternative development solution would be to use the Java programming language. Designed as a *"general-purpose, concurrent, class-based, object-oriented language"* [58] Java is a platform-independent programming language that would allow an application to be developed once and deployed successfully across operating systems. In effect, a Java application would operate as successfully in a Windows environment as an Apple OS environment. According to The Popularity of Programming Language Index (PYPL), which determines the popularity of programming languages according to the frequency on which tutorials are searched on Google; Java is the most popular programming language with a share of 22.7% [59].

Table 4 - Advantages and disadvantages of locally installed method.

Locally Installed	
Advantages	**Disadvantages**
Microsoft's Windows dominates Operating System market.	Only available on the device on which it is installed.
Java is platform independent.	Non-operational device may lead to data loss and damage to business operations.
Familiarity – Users are likely to be familiar with PC applications.	

2.8.2 Mobile Application

Within mobile application development there are two outstanding leaders in the field; iOS and Android. In the UK, sales of Apple and Samsung devices combined control over two thirds of the smartphone market sharing 68% of all smartphone sales (34% each)[60]. In terms of tablet devices it is the same two companies who lead the way occupying 85% of the market, although in this area Apple are the significant leaders with iPad ownership accounting for a phenomenal 76% of tablet sales in the UK between 2012 and 2017 [61]. Furthermore, when considering operating systems irrespective of device, iOS and Android control a staggering 98.6% of all mobile devices in the UK and Europe [62].

iOS

iOS is the operating system designed, developed and distributed with all mobile Apple products. To develop applications for iOS devices requires the developer to be using an Apple device running Xcode, which is Apple's Integrated Design Environment (IDE) for the development of applications in Apple's Swift programming language [63].

Android

Alternatively, developers looking to develop for the Android platform are provided greater freedom in their choice of IDE but a leading option is the official offering of Android entitled Android Studio [64]. Android applications are largely built using the platform-independent Java programming language which affords users more freedom to develop in Windows, OS X and other operating systems with which they are comfortable.

Xamarin

Additional consideration should be given to a Windows tool called Xamarin that allows developers to create applications for iOS, Android and Windows in the Windows environment while compiling natively for each platform. Since Microsoft acquired Xamarin in 2016 [64] its popularity has grown rapidly owing to its functionality that users can develop a single code base that compiles to a native application on multiple operating systems [65].

Table 5 - Advantages and disadvantages of mobile app method.

Mobile App	
Advantages	**Disadvantages**
Mobile app popularity continues to grow rapidly.	Recordings with large bodies of text are difficult to input on mobile/table screen.
Familiarity – Users are becoming increasingly familiar and dependent on mobile apps.	Non-operational device may lead to data loss and damage to business operations.
Portable device allows users greater freedom in where they create and retrieve data.	

2.8.3 Web-based Application

The final development platform considered is a web-based application often referred to as a web app. Web apps are often a dynamic data-driven website that allows a user to perform tasks and functions where processing and computation takes place on an external server [67]. It requires little more than an internet connection and a browser for a user to access and the application's performance is not dependent on the resources of the local machine.

PHP

PHP, as defined by its developers, is an *"open source general purpose scripting language that is especially suited for web development"* [68]. PHP code embedded into HTML is pre-processed by the server on which it is stored and the results are delivered to the user is plain HTML. As a result, PHP allows a developer to create a dynamic website capable of retrieving data and performing complex calculations without requiring the resources of the user's local machine. This powerful functionality and the fact that PHP's primary focus is the development of web apps are key reasons why it is used by 83.2% of websites that utilise server-side scripting [69].

ASP.NET

ASP.NET is the closest competitor to PHP in terms of server-side scripting language popularity among websites, but with a market share of just 13.8% it is dwarfed by PHP's widespread use [69]. The offering of Microsoft is an open source web framework designed for the development of web apps and services [70]. ASP.NET is also server-side scripting language processed by the server on which it is stored and delivers its results in plain HTML.

HTML5 / CSS / JavaScript

Although web apps rely greatly on server-side scripting languages to perform much of the processing and calculations this alone would not produce a suitable solution. Server-side processing allows for data retrieval and computation but client-side languages and functions must also be performed to properly deliver to the content to the viewer. Client-side languages and functions are those performed on the user's device and are most often concerned with the rendering and display of a web page. These features will be vital in delivering a successful web app and will be used in all aspects of development.

The most fundamental building block of web design is HyperText Markup Language (HTML) which defines the content and layout of a web page [71]. Web pages also make use of Cascading Style Sheets (CSS) which contain styling rules and describes how elements of a web page should be rendered in the viewer's browser [72]. Finally, it will also be necessary to harness the power of client-side programming language JavaScript. JavaScript is a lightweight language best known for its use in web pages and is most often used to perform functions according to user enforced events such as button clicks [73].

Table 6 - Advantages and disadvantages of web app method.

Web App	
Advantages	**Disadvantages**
A web app would be accessible from any internet connected location.	Requires internet connection.
Platform and device independent.	Web hosting companies offer security and data backup guarantees.
Web app performance is not hindered by computing resources of the viewing device.	

2.8.4 Conclusion

Having considered the available platforms for development it is believed that a web-based application would be the most suitable solution to meet the requirements of Little Flowers.

While each of the development routes present their own advantages a web app would afford Little Flowers the most benefit. These benefits include:

- Access anywhere – A web app would require no more than an internet connected device with an internet browser. This would provide a level of freedom and access to their data and operations that other solutions would not. It would also negate the risk of inoperable devices resulting in irrecoverable data loss.

- Performance – The performance of the web app will not be influenced by the resources available of the device on which the web app is utilised. As a result, Little Flowers staff would be able to retrieve data as easily on a mobile or tablet as they would a computer.

- Parents – Parents, as the paying customers of Little Flowers, will immediately recognise the benefit of being able to view information pertaining to their children through a web app which allows them to view records from any internet connected device whether it be at home, in the workplace or abroad.

- Security – Web hosting business 1&1 are one of the market leaders in the UK and may be a suitable service for Little Flowers. By deploying a web app through a service supplier such as 1&1, Little Flowers will benefit from 1&1's commitment *"to ensuring the very highest levels of security and safety with all of our services"* [74], practiced through the use of enhanced SSL certificates, external firewalls and data backups and recovery.

Having analysed both PHP and ASP.NET it has been decided that PHP will be the server-side programming language used to develop the Little Flowers web app. Although PHP and ASP.NET offer a great deal of similar functionality, the popularity of PHP suggests a widespread confidence in its ability. Due to its widespread use, PHP also benefits from a very loyal open source community that provide support and guidance through their official website and on popular forums such as StackOverflow. Finally, PHP is a free and open source programming language which benefits a small business such as Little Flowers as it reduces the initial cost of development and deployment [75]. All client-side, server-side and design code will be developed using the Atom IDE package and will be tested locally using XAMPP and the Google Chrome and Mozilla Firefox internet browsers.

2.9 Critical Review

The investigation into the modern childcare profession and the available methods of creating, maintaining and sharing documentation has confirmed that although it is a legal requirement to retain recordings no industry standard means of doing so is enforced. Subsequently, childcare settings adopt either a paper-based or digital method of recording information. The research undertaken has corroborated the belief that small childcare settings, such as childminders, can see immediate positive impact on efficiency by employing a digital solution.

Childcare as a profession has seen continued growth over a number of years owing largely to the changing role of women in society and cultural shift in family dynamics. As a result, women make up a larger percentage of the workforce than ever before meaning children are more likely to require the care and services of professional childcare settings.

It has been determined that no suitable tool currently exists and that a bespoke web app would satisfy the needs of Little Flowers most successfully.