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PHD AND CHILDBEARING?

WORK-LIFE BALANCE OF FEMALE PHD STUDENTS
IN THE FIELD OF ENGINEERING

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Doctoral Thesis

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1. INTRODUCTION

This dissertation is based on a qualitative research project using semi-structured interviews to explore what dilemmas young women PhD students' experience as engineers and what strategies they make use of in relation to their work-life balance.

1.1. Research problem

The issue of work-life balance (henceforth, WLB) gained more attention after the radical expansion of the female labour force since the 1950s. This rising participation was a consequence of changes in broader economic and labour market processes, social policies, and values: there was an urgent need for female workforce after the second world war; poverty was eased by women's income and the dual-earner model; the de-industrialisation and the shift to the service sector gave women a way to move into traditionally male occupations, such as engineering. The demand for workplace flexibility and childcare support increased partly due to the greater number of single parents and the changing attitudes and aspirations of women regarding their family roles and fulfilment (Crompton et al. 2007). Recently, almost two-thirds of women are part of the labour force, including young mothers in rising numbers (OECD 2020). Governments still aim to foster women's participation, emphasising that women's employment creates new jobs in caring and domestic work and also contributes to the rising cost of welfare (Esping-Andersen 2002).

The changes in productive labour have not been followed by changes in the family roles, therefore balancing work and family life became and have remained a major issue for women (Nagy 2009). Despite their full employment, women have remained responsible for care work and household chores (Craig – Mullan 2011); meanwhile men have not become responsible for significantly more household work, let alone as full-time homemakers. WLB has long been considered as women's private issue and women's "double burden" has not decreased significantly in the past decades (Szalma et al. 2020, Hochschild 1989). Though positive attitudes towards and the acceptance of working mothers have been increasing (Schwartz – Han 2014), and the problem of balancing employment with family has been increasingly relevant for men as well (Geszler 2016, Allard et al. 2011), women – especially young mothers –, struggle and sacrifice more due to the conflict of work and family life (Mason et al. 2013). Meanwhile, more and more research studies and governments have started to recognise its gendered nature and the vital role that institutional and structural factors play in WLB (Toffoletti – Starr 2016).

WLB is especially challenging for higher educated women in high-status occupations, such as research and development (Nagy – Paksi 2014, Fox et al. 2011), and the issue continuously has been gaining publicity in top-referred journals as well, such as Nature (Leventon et al. 2019) or the Forbes (Kohll 2018). It is a paradoxical situation that while female professionals have higher education, salaries and more opportunities in their careers than their previous generation's counterparts, they still face incompatible expectations stemming from both life spheres (Bonache et al. 2022, Hewlett et al. 2008). Recently, the neoliberalised academia has been particularly jeopardising work-life balance for women (Rosa 2022). Regarding work, an academic career expects the lock-step advancement of researchers through the academic pipeline (Moen – Sweet 2004), with total devotion to work, high performance and productivity (Ferree – Zippel 2015). Regarding private life, even breadwinner professional women are often solely responsible for the household and child care responsibilities, which leaves them with less time and energy for their professional work (Bomert – Leinfellner 2017, Schiebinger – Gilmartin 2010, Santos – Cabral-Cardoso 2008). While fatherhood usually has positive impacts on male professionals' careers, women struggle with WLB, particularly with the timing of motherhood (Ridgeway – Correll 2004, Paksi et al. 2016). As a consequence of this work-family imbalance, the proportion of single and/or childless female professionals is far higher than that of their male counterparts. They often postpone motherhood, and young mothers are susceptible to slow career advancement (Mason et al. 2013).

Balancing a high commitment career and family life can be more demanding for women in the male-dominated fields of science, technology, engineering, and mathematics (STEM). Women are underrepresented in these fields, especially in senior or top positions, compared to not just their male colleagues but also to their female counterparts in social sciences and humanities (Xie et al. 2015, Burke – Mattis 2007). One of the most determining reason is that both male-dominated environment and the masculine view of science (Blickenstaff 2005) often transmit highly negative messages towards women in the forms of stereotypes, biases, and discrimination regarding their family and gender roles, and also prejudice against their professional knowledge (Maxmen 2018, Powell et al. 2009). This "chilly" environment for women (Maranto – Griffin 2011), along with the knowledge-intensiveness of STEM fields, can badly influence women's reconciliation of work and family life, and women often are dissuaded from a career in science, particularly after obtaining PhD (Cech – Blair-Loy 2019, Hayes – Biglerb 2013, Lewis – Humbert 2010). This phenomenon is relevant both in the USA and the EU member states, even in the more gender-equal Nordic countries (Stoet – Geary 2018).

Finally, the issue of WLB is furtherly relevant in the Hungarian context, where the traditional share of family roles and the historically long institution of long maternity leave have hardly changed (Gregor – Kováts 2019). Women's participation is STEM fields is also low, and the low gender equality and awareness in the Research and Development (R&D) sector are not conducive to providing a warm, inclusive environment for women with caring responsibilities (Tardos – Paksi 2021). Moreover, Hungarian women become mothers at earlier ages then in western, southern or the Scandinavian countries (Eurostat 2018), which could make the timing career and childbearing a hot issue for them (Paksi – Szalma 2009). Though several domestic studies called attention to this problem (Lannert – Nagy 2019, Paksi 2014, Pető 2018, Haraszthy – Hrubos 2002, Acsády 2010), only a few empirical investigations were carried out into the issue (Engler et al. 2021, Takács 2020, Nagy 2014, Schadt – Péntek 2012, Palasik 2003). Moreover, academic stakeholders have just recently recognised how the academic pipeline leaks for Hungarian women researchers (Somogyi 2016).

1.2. Thesis statement

Though the above introduced effectively indicates how the WLB of female researchers is constrained, there have been gaps in research knowledge, especially in the Hungarian context.

Firstly, though women tend to leave science after obtaining the PhD, we have little information – particularly in Europe, and also in Hungary – on their experiences during their PhD studies. PhD education is already a part of the academic career and socialisation during this period has its utmost importance which can influence their career decisions (Eddy – Gaston-Gayles 2008). Doctoral students tend to juggle multiple life domains: education, work, private and family life and are often characterised as a highly vulnerable social group regarding precarious employment and burdening working conditions (Mavriplis et al. 2010, Kurtz-Costes et al. 2006).

Secondly, WLB-related problems seem to be more troublesome in male-dominated knowledge-intensive fields, such as engineering and informatics, where women's representation is the "lowest low", and working environments are "chillier" even within STEM fields (Shauman 2017). In engineering, the already multiplied roles and identities of female PhD students could also intersect with the masculine characteristics of STEM fields. Female PhD students at the bottom of the academic hierarchy, probably have fewer opportunities and tools compared to their male counterparts and senior colleagues to fight their way through in highly masculine environments of their research-intensive profession (Herman et al. 2013). Moreover, in several

disciplines, laboratory work could also severely interfere with WLB. In the meantime, "Women in science" research is still scarce in Europe, particularly with a single focus on WLB issues, and the role of health risk of laboratory work in WLB – to my best knowledge – has been entirely unexplored.

Finally, though the timing of childbearing of female academics has its vital importance both in individual and academic life courses, research acknowledges poorly that they are typically female PhD students whose family establishment overlap with the "ideal" ages of becoming a mother (Mason et al. 2013, Jacobs – Winslow 2004). Postponed childbearing of higher educated women is well documented in statistics; however, the lack of qualitative answers for "why" and "how" women decide on the timing of their childbearing is also a research gap.

I propose in this dissertation that young women researchers in STEM fields face significant WLB-related obstacles even as early as their PhD education due to the intersection of their gender, age, parental status, nationality, and also with the characteristics of their strongly male-dominated, knowledge-intensive occupation, particularly if it involves laboratory work with hazardous substances.

In sum, answers are still needed to the following questions, especially in Hungary: How do young women researchers balance several life domains during PhD education in STEM fields? What factors foster or hinder their WLB mainly? Do early WLB experiences influence their family and career plans? How do male-dominated environment and laboratory work affect their WLB? Do they plan to become a mother? If so, when and how can they integrate childbearing into their academic career?

The *purpose* of this dissertation is to find answers to these questions; therefore, 27 semi-structured interviews were conducted with female PhD students in engineering in Hungary. The research is embedded into the *dual theoretical framework* of work-life balance theories and the life course perspective. While WLB theories (Grzywacz – Carlson 2007, Greenhaus – Beutell 1985) help to understand the relationship of school, work and family life, the life course approach highlights how the critical intersection of individual and academic life courses affect WLB, especially the timing of childbearing (Castaño – Webster 2011, Moen – Sweet 2004). Putting the WLB of women under the microscope at early-stage academic career is also highly relevant not "just" morally but also economically. Though governments in developed countries – particularly in the EU – took steps to increase the number and the proportion of women in science, a significant proportion of female PhD students (and also doctorate holders) are still

dissuaded from academic careers (Beddoes – Pawley 2014, De Welde – Laursen 2011). At the same time, the supply of graduates is insufficient to cover the growing labour market demands for highly skilled professionals. Research findings of this dissertation can enhance the WLB of young researchers and may contribute to the elimination of barriers to women's professional advancement and to the increase of the proportion of women in STEM fields.

It is a limitation that findings cannot be widely generalised. However, the explorative research design allows the collection of a wide range of information on young female engineers, and the sample is eligible to describe the main patterns, which all lead to a deeper knowledge on this under-researched area. Results can also help to highlight and understand WLB-related problems of women in other disciplines, especially those working in laboratories. Finally, results can provide not just intervention points for stakeholders but also useful strategies for these women researchers' peers.

1.3. Structure of the dissertation

The dissertation consists of eight chapters. In the next chapter, the dual theoretical framework is introduced. The third part discusses the previous empirical findings on the WLB of female professionals with special attention to PhD students, the timing of childbearing and the STEM context. The Hungarian context and previous findings are presented in the fourth chapter. The research questions are developed in the fifth part, while the sixth chapter describes the qualitative research design. The seventh part is the heart of the paper, where research findings are presented. After discussing the contributions of the dissertation to the existing theoretical and empirical results findings, main conclusions, limitations, and future research will be set out in the eighth and final chapter.

2. THEORETICAL FRAMEWORK

The present research is based on a dual theoretical framework encompassing main w*ork-life balance theories* (Greenhaus – Beutell 1985, Grzywacz – Carlson 2007) and the *life course perspective* (Moen – Sweet 2004, Huinink 2013). On the one hand, WLB theories help to understand the relation (e.g. segmentation, conflict or balance) of the different life spheres[1] (education, job, private and family life) of young female engineers. Nevertheless, WLB theories tend to lack the gender perspective (Chang et al. 2009) and to obscure structural, cultural and relational constraints and norms by which gender inequalities are reinforced and reproduced (Lewis et al. 2007). On the other hand, the life course perspective goes far beyond the work-family interface dichotomy. It takes into consideration the gender dimension, the intersection of academic and family life courses, as well as the effects of institutional and structural factors and the normative context (Ward – Wolf-Wendel 2012), by which we do gain a deeper insight into the plans and decisions of PhD students on the timing of childbearing (Kohli 2007). For the present research, I applied WLB theories and the life course perspective as interdependent and complementary theories. This dual framework and the intertwined interpretation of the findings generously allow a more complex understanding of the WLB of these young female professionals. The development of a new model fell beyond the aim of the dissertation.

In the following, firstly, the WLB (chapter 2.1), then the life course perspective (chapter 2.2) are introduced.

2.1 Work-life balance theories

WLB theories are primarily rooted in the discipline of psychology, and gained their own relevance in sociological research as well (Chang et al. 2009). *WLB theories* are frequently used as an umbrella term that includes the wide range of investigations into the different relationships of the different life domains of individuals (Eby et al. 2005). Regarding the life domains, they are distinguished in the literature according to what social roles individuals ascribe to them. *Work* domain, for example, includes employee or manager roles, while *nonwork*[2] or *life* domains include every other role, such as family[3], religion, leisure or student roles. Regarding the

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[1] The terms life sphere, life domain, sphere and domain will be used as synonyms in the dissertation.

[2] Though nonwork-related tasks also include work, the term *work* typically refers to paid work and is synonymous with employment (Clark 2000). *Work-nonwork* and *work-life* distinctions are used interchangeably, where *life* or *nonwork* also does not imply that work cannot be a part of someone's life.

[3] The term *family* refers to *"two or more individuals occupying interdependent roles with the purpose of accomplishing shared goals"* (Eby et al. 2005).

relationship of the life domains, it has been meticulously explored and described by different WLB theories and concepts, such as segmentation, spillover, compensation, work-family conflict, positive concepts, border theory, work-family balance and fit, agencies and capabilities concepts (for references see the text below).

In the following, these above mentioned main WLB theories and concepts are introduced. Special attention will be devoted to work-family conflict (henceforth WFC) and work-family balance (henceforth WFB), as – in spite of the proliferation of WLB research –, they are the most relevant and most frequently examined life domains (Grzywacz – Marks 2000, Kalliath – Brough 2008). The introduction starts with a brief summary of the work-family interface, which helps to understand other life domain relations relevant to the present research, such as the education-family or education-work interfaces. In the dissertation, I apply the umbrella term of WLB, but where it is relevant, I also use the terms WFB and WFC.

2.1.1 Work-family interface

Research on the work-family interface has a vast academic literature and has attracted public and governmental interest. It is continuously formed by new and more complex methodologies and research concepts of middle-range theories (Dén-Nagy 2013). Work-family research proliferated, especially in Anglo-Saxon countries, where the neoliberal context with the low regulation of the labour market challenged the reconciliation of women's work and family life. In the 1960s, the focus was on working mothers and dual-earner families due to women's increased participation in the labour market and the aim of equality for women in the employment of second-wave feminism. Later, during the 1980-90s, WFC came into research focus due to workplace changes, stress and burnout concerns. In the 1990s, the more inclusive term of "work-life" gained attention instead of "work-family", which was a backlash against those work-family policies that excluded men or women without children or having other responsibilities than children (Lewis et al. 2007, Moen 2011, England 2010).

Before going into details of the different WLB theories, it is worth glancing at the following four aspects of the work-family interface, which help to understand the relationships of the different life domains. The first aspect is the *amount of* work-family interface, which shows the degree of segmentation or integration of work and family domains (Rantanen 2008). Life domains are segmented by different boundaries imposed by individuals, such as temporal boundaries that structure the use of time and spatial boundaries that structure our physical location (Frone 2003). Earlier research considered life domains segmented from each other, while more recent research has been highlighting their interactions (Grywancz – Marks 2007).

The *direction* of the work-family interface refers to the bi-directionality of effects that can flow from work to family, or conversely. The two directions are linked in a reciprocal way. If individuals experience conflict in the one direction of conflict, they are also likely to experience it in the other way (Gutek et al. 1991, Frone et al. 1992). The *quality* of the work-family interface describes whether the interactions between the life domains are negative or positive. After highlighting the negative quality, researchers realised the positive relations of work and family domains (Greenhaus – Powell 2006). The fourth aspect is the *context*, which shows from which perspective the phenomenon is examined. While the microsystem level of work-family interface constitutes individual face-to-face experiences in both domains, the mesosystem includes even linkages and reciprocal effects between individuals and role partners (i.e. the positive role of spousal support in WLB). The exosystem context considers the impact of a third life domain in which the individual is not involved (i.e. an individual's performance is affected by workplace stress experienced by the spouse). Finally, the macrosystem refers to a broader social context, such as differences according to larger groups, subcultures or countries (Rantanen 2008).

2.1.2 Segmentation, spillover and compensation theories

The *segmentation theory* (Evans – Bartolome 1984) gained attention at the beginning of WLB research. This theory was mainly relevant in the 1960s and 1970s and claimed that work and family life domains are relatively separated in time, space and function, therefore, they do not affect each other. In the last decade, a significant shift in the research focus can be observed. Research pointed out that work and family life are closely related and separation does not occur naturally. Instead, separation is a result of an active process based on individual choices (Edwards – Rothbar 2000). Others emphasised that segmentation can be considered as a coping strategy in a way that individuals suppress their thoughts or feelings or behaviours belonging to the different life domains and do not let them interfere with each other (Lambert 1990). These "segmentors", for example, do not speak about their family at the workplace, or they do not take work home. Meanwhile, "integrators" allow work or family to flow into the other domain, such as having family pictures in the office or taking work home. However, segmentation and integration always lie on a continuum, and the complete forms are sporadic; the boundaries are somewhat blurred between the spheres (Clark 2000).

Newer concepts considered work and family as interdependent fields and have started to focus on the quality of this interdependency (Roehling et al. 2003). One of the most influential concepts is the *spillover theory*, which states that the flow of the different effects between work and other life domains seems hardly avoidable. Roles belonging to life domains can coexist at

the same time and cannot be separated. Life domains affect each other: individuals carry different moods, emotions, values and skills from one life domain to another (Tammelin 2009). The essence of the theory is that these filtering effects only become spillovers if they cause similarities between constructs of life domains in terms of mood, satisfaction, values, skills or behaviours (Edwards – Rothbar 2000). Firstly, the negative, then the positive spillovers became the focus of research, and the new focuses were the correlation between job satisfaction and subjective well-being and other positive effects, job flexibility or coping strategies and gender differences (Király et al. 2015). Powell and Greenhaus (2010) pointed out that segmentation of life domains can enhance WLB, but it also impedes the flow of positive spillovers. *Compensation theory* is complementary to spillover theory, which posits a specific relationship between life domains and postulates that if individuals are dissatisfied in one life domain, they seek satisfaction in the other(s) (Staines 1980). Meanwhile, both approaches can occur simultaneously in an individual's life (Lambert 1990). Their common limitation is that they address only emotions and fail to examine other linkages between the life domains, such as temporal, spatial and behavioural connections (Zedeck 1992).

2.1.3 Conflict theory

The conflict theory introduced by Greenhaus and Beutell (1985) is one of the earliest and most widely used perspective of the work-family interface (Barnett 1998, Eby et al. 2005, Chang 2009). It was mainly based on the *role stress theory* and *scarcity approach*, which emphasised the opposition of the work role and other life domains' roles in terms of stress and energy (Kahn et al. 1964, Marks 1977, respectively). Four types of role conflict were identified by Kahn and colleagues (1964): intra-sender (when the same person imposes incompatible expectations), inter-sender conflict (two or more persons' contradicted demands), inter-role conflict (role pressures of life domains that are in conflict), and person-role conflict (requirements of a role conflict with the individual's needs or values).

Greenhaus and Beutell (1985) went further on Kahn and colleagues' work (1964), especially on the notion of inter-role conflict. In their most widely cited definition, they refer to the incompatibility of work and family spheres as follows: WFC is *"a form of interrole conflict in which the role pressures from the work and family domains are mutually incompatible in some respect. That is, participation in the work (family) role is made more difficult by virtue of participation in the family (work) role."* (Greenhaus – Beutell, 1985:77). The authors proposed three forms of WFC based on their source (time-based, strain-based and behaviour-based) and also identified both family- and work-related sources of conflict in each form. Each form of

conflict can occur in both directions (work-to-family and family-to-work), and implies the impossibility of the fulfilment of both work and family-related roles. In conflict theory – similarly to spillover theory –, experiences are also transferred to the other domains. However, in the case of the first, incompatibility prevents individuals from fulfilling the requirements, while spillover makes long-term similarities between the constructs of domains, such as when continuous stress is experienced at the workplace result in insomnia at home in the long run.

The first form of conflict distinguished by Greenhaus and Beutell (1985) is the *time-based conflict*, when the time pressure of each life domain is incompatible with the other(s). Conflicts can arise when time devoted to work (or family) makes it difficult to meet the expectations of roles in the other domain. It is not necessary to be present physically in the life domains; the pressure can make one preoccupied with one role while being in the other. The authors in their literature review found strong evidence for time-based, work-related sources of conflicts. The number of working hours per week, the irregularity of shiftwork, the inflexibility of work schedules and work commitment all positively correlated with work-family conflicts. Meanwhile, the role of flexibility was not strongly positive, for example, in the case of individuals with childcare responsibilities. Meanwhile, many family-related sources of conflicts, such as marriage and parental status, especially with young or several children, positively correlated with family to work conflicts. The number of husbands' working hours also acted negatively and caused conflicts in women's lives, and husbands of professional women also experienced more intense time-based conflicts (Greenhaus and Beutell 1985).

In the case of the *strain-based conflict*, strains deriving from one domain hinder individuals in complying with the demands of another domain. Greenhaus and Beutell (1985) also reviewed work- and family-related sources of strain-based conflicts, namely work stressors and family stressors. Work stressors can produce strain symptoms in individuals' lives, such as anxiety, tension, fatigue, depression. They positively correlate with the low level of leader support at the workplace, boundary-spinning activity, mental concentration at work, while the role of work autonomy can be both positive and negative. Concerning family stressors, the lack of support also positively correlated with strain-based conflict. Supportive spouses eased strain-based conflict for the partner, which explained another finding that women with husbands with different career orientations experienced higher strain-based conflict levels. Finally, a high level of time involvement also produced direct or indirect strain-based conflict, similarly to time-based conflict (Greenhaus – Beutell 1985).

The third, *behaviour-based conflict* occurs when an expected behaviour in a work (or family)–related role is incompatible with the anticipated behaviour in a role belonging to the other domain (Greenhaus and Beutell 1985). For example, stereotypes related to male manager roles may demand self-reliance, emotional stability and objectivity. In contrast, these managers' families can expect entirely different behaviours at home: being emotional, warm and kind. The authors highlighted that research directly addressing the issue of behaviour-based conflict was scarce at that time. Though a few later analyses introduced some findings, such as that work-family conflict, Type A personality (ambitious, persistent, impatient, involved in work) or having children were significantly positively correlated with behaviour-based conflict (Carlson 1999), later studies did not confirm these findings (Bruck – Allen 2003). Experts warned that the issue needs further exploration (Ford et al. 2007); for example – instead of employment conditions, autonomy and skills – it would be worth examining the actual behavioural requirements of the work roles (Dierdorff – Ellington 2008).

Greenhaus and Beutell's work (1985) inspired a wide variety of researchers from various disciplines (Chang et al. 2009). Research mainly focused *firstly* on the unique work and family antecedents of WFC, such as social support (e.g. instrumental aid, emotional concern), involvement-engagement (psychological and cognitive preoccupation), role conflict (an incompatibility of roles), time demands (time devoted to roles) and role ambiguity (lack of necessary information or role clarity), *secondly*, on the unique outcomes of WFC, such as job or family satisfaction and overall life satisfaction (Michel et al. 2011). *Finally*, recent research has started to explore the mediating effects of WFC on work, family and individual outcomes (Kossek et al. 2012, Voydanoff 2002).

2.1.4   Positive concepts and border theory

Scholars developed different concepts for the positive work-family relationship since the 1970s, but their broader use began only in the 1990s (Kirchmeyer 1992, Grzywacz – Marks 2000). These positive concepts were mainly based on, firstly, Sieber's *role accumulation model* (1974), where *"The benefits of role accumulation tend to outweigh any stress to which it might give rise."* (Sieber 1974:567). Secondly, on Marks's *expansion model* (1977), which considered personal resources expandable in a way that some roles do not imply energy loss, but can even create energy for other role performances, namely they support each other in mutual, productive ways. These positive concepts – such as *facilitation* (Grzywacz – Marks 2000, Frone 2003) and *role enhancement theory* (Tiedje et al., 1990, Voydanoff 2002) highlighted that being involved in multiple roles protects individuals from negative experiences (Barnett – Hyde 2001) and

decrease work-family conflict and stress (Marks – MacDermid 1996, Frone et al. 1992). It also has positive outcomes (namely, rewards or role-privileges): status security, status enhancement, personality enrichment, enhanced self-esteem or a sense of purpose in life (Wayne et al. 2004, Grzywacz – Bass 2003). Later all these positive work-family interfaces were labelled by the umbrella term of *"enrichment"* by Greenhaus and Powell (2006).

Finally, another line of research went beyond this approach, and new models claim that individuals can actively form their own work-family interface up to a certain level (Clark 2000). Though prior theories brought on the notion of the boundary of work and family domains, only later research started to examine its role in a complex way. Border theories (Clark 2000) aim at understanding how individuals segment or integrate their life domains, how they use the borders, and how it affects their work-family balance. Clark (2000) highlighted that borders are permeable and their permeability shows to what extent elements of a life domain can enter into another domain. Its flexibility refers to what extent a border can be contracted or expanded. The author called the phenomenon "blending" when a border is highly permeable and flexible at the same time, such as in the case of family-run businesses. Conversely, a border is called "strong" when it is highly impermeable and inflexible and does not allow any blending. The role of communication and central participation are important tools by which individuals are able to form their environment up to a certain level and able to achieve a more or less balanced life. (Clark 2000).

2.1.5   Work-family balance and fit

After the shift in research focus towards investigating the positive interactions of work and family life, research has started to explore the essence and the quality of it (Edwards – Rothbard 2000). This initial WLB research examined how a "good" balance contributes to individuals' wellbeing, quality of life, organisational performance and thus to a healthy society (Halpern 2005). Positive role quality – such as more rewards and less concern experienced in a given role – was positively correlated with low work overload, role conflict and anxiety (Barnett – Baruch 1985). Meanwhile, the absence of balance led to greater turnover intention (Allen et al. 2000) and more frequent sickness absence at the workplaces (Jansen et al. 2006). Later research (Marks – MacDermid 1996) considered role balance not as an outcome of prioritised roles but as a behavioural pattern (acted across roles) and as a corresponding cognitive-affective pattern (that organises individuals' inner life of multiple selves). According to the authors, positive role balance occurs when individuals are engaged in every role with the same high level of effort, attention and devotion. A negative role balance occurs when individuals are fully disengaged

in every role. While the first case eases role strain, the second leads to role strain (Marks – MacDermid 1996).

Recent research has started to differentiate WFB research according to its approach and distinguishes the "overall appraisals approach" and the "components approach" (Grzywacz – Carlson 2007). Research studies using *overall appraisals approach* usually defines balance exclusively as an integrated, harmonious and satisfying relationship of work and family life. For example, *"equilibrium or maintaining an overall sense of harmony in life"* (Clarke 2004:121) or *"satisfaction and good functioning at work and at home, with a minimum of role conflict"* (Clark, 2000:751). Overall appraisals research consequently measures WFB with a single-item question on the general assessment of individuals on their own WLB (e.g. *"All in all, how successful do you feel in balancing your work and personal/family life?"* (Clarke 2004:127). The *components approach* emerged when new research supposed that balance should be more than simply the lack of conflict or interference of different life spheres (Frone 2003). This approach went beyond role balance theory and the pure conceptualisation of sources of balance, and it examined the various components of WFB. These conceptually based measurements – including the interference between and the bi-directionality of life domains – enabled a more precise and clear understanding of the unique and different antecedents of WFB (Rantanen et al. 2011).

Grzywacz and Carlson (2007) tested a four-fold taxonomy model of conflict and enrichment and compared the result with a measurement using the overall appraisal approach and found that the components approach consistently explained more variance in work and nonwork outcomes (Grzywacz – Carlson 2007). Based on the review of research studies using the components approach, Grzywacz and Marks (2007) concluded that work-family facilitation could be another component of WFB beyond WFC. Their four-fold taxonomy of conflict and facilitation showed that WFB results from a high level of enrichment and a low level of conflict. This taxonomy was tested by others, using similar terms for positive interactions, such as enhancement (Rantanen 2008) or positive spillover (Grzywacz –Marks 2000) and enrichment (Grzywacz – Carlson 2007). Finally, Greenhaus and colleagues (2003) proposed that role engagement can be further divided into three elements, such as time balance (equal time devoted to both work and family roles), involvement balance (equal psychological involvement in both roles), and satisfaction balance (equal satisfaction with both roles). In their model, balance meant that individuals demonstrate equally positive commitments to work and family roles (Greenhaus et al. 2003).

Though the different WFB measurements revitalised and strengthened the discourse on the meaning and definition of WFB, there has still been a lack of consensus on its definition, components or measurement. Greenhaus and his colleagues (2003), as we saw above, did not consider balance as a linking mechanism but as an individual orientation, which does not organise roles in the hierarchy – similarly to Marks and MacDermid's notion (1996). They defined WFB as *"the extent to which individuals are equally engaged in and equally satisfied with work and family roles"* (Greenhaus et al. 2003:513). They also emphasised that individuals are considered imbalanced even if their favour in work role or family role is consistent with their want or values, and hinted that such an imbalance is healthy or not is an empirical question.

Reiter, in her work (2007) challenged this absolutist "one size fits all" WLB definitions that were irrespective of job and family demands, family structure or financial pressures. She offered a situationalist perspective, which takes into consideration the values, needs, and desires of individuals and emphasised that individuals have optimum choices. Meanwhile, she also remarked that the hierarchy of roles is neither necessary nor desirable for WLB (Reiter 2007). In parallel to this, Grzywacz and Carlson (2007) further argued that the overemphasis of the role of individual satisfaction is problematic because it isolates individuals from the organisations and their families and posits WFB as a personal issue and responsibility. They also claimed that WFB is shaped by not just individual but contextual factors, and therefore WFB is rather a social construct than a psychological one. They defined WFB as the *"accomplishment of role-related expectations that are negotiated and shared between an individual and his or her role-related partners in the work and family domains."* (Grzywacz – Carlson 2007:458).

Finally, to find the way in the labyrinth of WLB theories, Kalliath and Brough (2008) reviewed the conceptualisation of WLB in literature and identified six types of definitions: multiple roles; equity across multiple roles; satisfaction between multiple roles; fulfilment of role salience between multiple roles; relationship between conflict and facilitation; and perceived control between multiple roles. Meanwhile, Rantanen and her colleagues (2011) concluded on three essential aspects of WLB: a) WLB is not unidimensional but rather is a *"conglomeration of multiple measurable constructs"* (Rantanen et al. 2011:31-32) and role balance can occur if high rewards and enhancement are combined with low concerns and conflict across the domains, for it is beneficial for individuals' well-being; b) WLB is formed by not only role-related demands and resources but by individuals' actions and attitudes; c) WLB leads to satisfaction which enhances the general sense of well-being (Rantanen et al. 2011).

Work-family fit is also a relatively new concept. It traces back to person-environment fit theory, which aimed to understand how job demands *and* personal abilities or family resources match (Voydanoff 2002). This approach also goes beyond those WLB definitions that considered balance as a lack of role conflict, as I described above. Primarily, it sought explanations of the phenomenon of why individuals who experienced WFC reported sometimes balance. The research highlighted that those who experienced WFC but evaluated their life as balanced perceived a better match between work and family; in other words, a subjective fit. Fit in this way *"reflects the degree to which workers can realize the various dimensions of their work/social system adaptive strategies, given the options available in the workplace."* (Barnett 1998:11). Later research further revealed that WFB and work-family fit have even different predictors: age, work hours, job and marital satisfaction, total family income, division of household chores were to be found as predictors of fit, while the frequency of family activities and also job and marital satisfaction acted as better predictors for WFB (Clarke et al. 2004).

2.1.6   Agencies and capabilities

Last but not least, recently, Hobson, Fahlén and Takács (2011) – based on Amaryta Sen's (2006) conceptual framework of *agencies and capabilities* – have offered a multidimensional, agency-centred approach for examining WLB. As work-family fit, this model also goes beyond the individual level. It highlights how individual choices are constrained how agency inequalities are embedded into different layers of institutional and normative contexts. While the work-family fit model focuses on that individuals can choose only from available options, the essence of this model is what individuals would choose if they had the capabilities to choose other alternatives and follow their choices. The authors developed a capability set for WLB adapted to the European context and collected those conversion factors that can shape the agency for claiming a (better) WLB. These factors include a) institutional factors (social rights, care benefits at policy level, and job quality, organisational culture, union, flexibility at firm level); b) individual factors (resources of individuals – namely the situated agency, human capital, income, network); and c) societal factors (different norms, discourses, media, social movements). These factors affect the access to resources, the freedom of choices and the sense of entitlement by shaping *"expectations and perceptions of the constraints and possibilities to make claims for WLB, and capabilities for making alternative choices for a better quality of life."* (Hobson et al. 2014:58).

2.2 *Life-course perspective*

The second pillar of the dual theoretical framework of the dissertation is the life course (henceforth: LC, plural: LCs) perspective, which allows a better understanding of women's WLB and their constrained careers in science (Castaño – Webster 2011, Moen – Sweet 2004). In the followings, the main features of LC perspective relevant to present research are introduced: firstly, the basic concepts of LC theory to understand the main characteristics of the LC perspective, then the most "gendered" dimensions of life courses: work, education and employment, lastly, the timing of childbearing.

2.2.1   Basic concepts

LC theory is dated back to, firstly, historical analysis preferring qualitative methods for understanding social changes in individuals' life as early as the end of World War I and the Great Depression (Elder 1974), secondly, to the mainly German quantitative sociology of analysing massive demographic data and trends (Mayer-Huinink 1993). The basic concept of LC theory is that human LCs consist of *"transitions and trajectories of roles and relationships over chronological time"* (Moen 2004, 2011), and are the results of various mechanisms, such as social structures, culturally coded beliefs, age norms, institutionalised transitions, individual decisions, socialisation processes and selection mechanisms (Mayer 1993). Human LC includes different LCs,[4] such as individual and family LCs, which are strongly connected and synchronised (Hareven 1991). LC theory primarily focuses on the intersection and the joint changes of LCs; on the timing, sequence of and transitions between life events, and on how individuals harmonise them (Marini 1984). LCs have been changing historically and can feature different patterns and processes, such as (de-)institutionalisation, (de-/re-)standardisation, (de-)differentiation, pluralisation and individualisation of LCs (Brückner – Mayer 2005).

The institutionalisation of the LCs was a consequence of the transformation of work in industrialised countries, the expansion of the educational system, the appearance of enormous work organisations and new welfare state policies in the 1970s (Brückner – Mayer 2009). The most determining process of the institutionalisation was that "modern" LCs became structured socially and temporally. They produced standardised and "normative" LCs in the forms of norms, beliefs, values, rights or different systems, such as work and education. The

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[4] The term of life course is often used interchangeably with life cycle and lifespan. These latter two rather have a connotation with biological age, therefore I use the term of life course, because it refers to the social embeddedness of individual biographies (Moen – Sweet 2004).

institutionalisation of LCs also decreased individuals' opportunities to shape their courses of life (Kohli 2007). Meanwhile, after a while, the process of de-institutionalisation also took place, when life events became reintegrated or fused, such as when work and education occur as parallel activities (Shanahan 2000). LCs can also be institutionally differentiated; for example, education or certain training can consist of different periods. While the term pluralisation of LCs is mainly applied to diverse family forms, such as the spread of extra-marital unions (Bumpass – Lu 2000).

LCs become standardised when they, or the timing of life events – such as maternity leave or retirement age –, become general and universal patterns in a given population. In contrast, LCs become de-standardised when the timing or the order of life events become a less valid or widespread pattern, such as the postponed timing of leaving the parental home, marriage and parenthood after the 1970s (Brückner – Mayer 2009). Individual options will not be, however, radically different or completely de-standardised, because they always strongly adjust to age norms. Thus, after a while, they become standardised again. Consequently, besides de-standardisation the re-standardisation of life courses (e.g. postponement of the first childbirth has become a general pattern) can be present at the same time. It is the "transitory case" of de-standardisation when after a certain period of de-standardisation, a re-standardisation begins, and the new pattern has been accepted by the whole population. In other words, institutional continuity is always coupled with some de-standardisation, but we cannot speak about de-standardisation in general (Huinink 2013).

The process of individualisation also appears in parallel with institutionalisation and standardisation, when individuals are set quite free from their social bonds, and life courses are determined to a lesser and lesser extent by status, locality or family of origin (Kohli 2007). These changes after the 1970s were ruled by the increased importance of individual choice, and basic value changes occurred in developed societies, turning into the direction of post-materialist values and demanding a high level of self-fulfilment. The number of available options open to individuals increased, and new patterns emerged and were spreading fast, such as single households, cohabitation, the postponement of marriage and parenthood, or deliberate childlessness (Lesthaeghe 2010). The contribution of individualisation to chronologically less standardised individual life paths was interpreted from different approaches. Some perceived individualisation as a modernisation process linked to postmodernity (Baumann 2013) or reflexive modernity (Beck et al. 2003). For others, it also meant breaking away from the traditional ways: traditional certainties – that acted through the structures of age, gender and

social class and used to determine individuals' lifestyles and life courses – have been disappearing, and the standard biography has become an "elective", "do-it-yourself", "risk biography" (Beck – Beck-Gernsheim 2002).

Scholars call the demographic changes that started in the 1960s in western countries described above the "second demographic transition" (SDT[5]) (Lesthaeghe – van de Kaa 1986). These changing LC patterns had spread widely in western countries and had started to flow towards post-socialist countries after the political system change (Lesthaege 2010). Recent trends show that there is still an increase in the variation of LCs in Central Eastern Europe[6]. Nevertheless, former socialist states placed normative constraints on the individualisation of LCS on an ideological basis, which prevented the fast de-standardisation of LCs in this region (Elzinga-Liefbroer 2007, Somlai 1999).

2.2.2 Gendered life courses

Only recent research has started to emphasise the role of gender that marks different LCs for men and women, particularly in work and education, which are the most determining factors of the institutionalisation of LCs (Moen – Sweet 2004, Kohli 2007).

Regarding work, LCs became highly institutionalised by a new work system based on the "Fordist" model in the 1960s. Career was conceptualised as *"a succession of related jobs, arranged in a hierarchy of prestige, through which persons move in an ordered (more-or-less predictable) sequence."* (Wilensky 1961:523). This career model was designed by and for (white) middle-class men and requires an "ideal worker", who is typically a man, highly devoted to work, works full-time or extra hours and who has a wife with family responsibilities described above (Acker 1990). With the increasing level of women employment, we can witness a considerable convergence between male and female life courses in the last few decades (Schwartz – Han 2014, Cotter et al. 2011). Though welfare states have become more responsive to new woman-centred life-course risks – such as the increase in childcare availability and enhancing WLB (Neyer 2013) –, the dominant work model is still not too reflexive in that women's employment is linked with (usually unpaid) family work (Bittman et al. 2003).

Young mothers' social status is often devalued at their workplaces because their gendered role of the primary caretaker is usually associated with lower ability and lesser general competence in paid work (Manchester et al. 2013, Ridgeway – Correll 2004, Perna 2001), which is

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[5] The theory is not fully accepted by all demographers, for critiques see Melegh – Őri (2003).
[6] With the exception of the Czech Republic (Elzinga-Liefbroer 2007).

inconsistent with the ideal worker type (Rosa 2021, Acker 2006). Even childless women are also often *discriminated* by employers who expect women to become a mother once (Knights – Richards 2003, Moss-Racusin et al. 2012). WFB has remained particularly problematic for women in Central-Eastern Europe (CEE), where flexibility is not an integral part of labour market policies (Křížková et al. 2010). Women often have to adjust their life course options to those of their male partners than vice versa (Kohli 2007): they postpone childbirth (Wagner et al. 2019) or give up their career perspectives (Lewis – Humbert 2010).

The other most determining factor of the institutionalisation of LCs is education. Though the transition into adulthood has become less standardised in general (Shanahan 2000) and it is still a widely accepted opinion that youths should only establish a family after they have finished school (Mynarska, 2010, Bernardi et al. 2008). The role of age in career-related transitions (such as leaving the educational system and having the first job) remained more robust than the role of age in family-related transitions (such as leaving the parental home or having the first stable partnership) (Corijn – Klijzing 2001). The median age of leaving school, therefore, had started to increase with the expansion of the educational system, thus, fewer years could be devoted to form a stable partnership, which also postpone marriage and parenthood. Nevertheless, the new pattern of becoming a parent during studies had also appeared (Huinink 2013).

Educational enrolment has a more substantial negative effect on the timing of family formation for women than for men (Corijn – Klijzing 2001). Education has become the most important marker of a successful life by providing human capital and higher income. If individuals invest more time in their education, their value of time increases. Parenthood is a highly time-demanding institution, particularly for mothers, who give birth to the children and tend to care them for a significantly longer time at home. Women who drop out of school or work face high opportunity costs[7] of childbearing (Becker 1981, Oppenheimer 1988), particularly in high-paid occupations, such as engineering[8] (Sobotka 2008, Spéder 2021, Hewlett et al. 2008). The opportunity cost is part of the motherhood penalty (Staff – Mortimer 2012): mothers earn less, have less work experience and productivity than fathers or childless men or women (Manchester et al. 2013, Budig – England 2001). They also tend to choose lower-paid family-friendly jobs,

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[7] The opportunity cost shows the cost of children, more precisely *"the income lost by a mother due to reduced employment or total absence from the labour force while bearing and raring children".* (Cramer 1979:177).
[8] Though the loss of potential lifetime earnings is higher for lower educated women, because they tend to remain housewives for the rest of their lives (Dankmeyer 1998).

part-time employment and are often discriminated by employers (Benson et al. 2017, Correll et al. 2007).

Regarding the target group of the present research – young female engineers –, attention must be called to the role of uncertainty and risk in shaping LCs. Economic and social changes in the last decades made individuals face increasing structural insecurity (Blossfeld et al. 2005). Youths and women are particularly exposed to it due to their unstable socio-economic status, including precarious employment: short fixed-term work contracts and low incomes even in prestigious jobs (Leathwood – Read 2020, Ivancheva et al. 2019, European Commission 2012, Bernardi et al. 2008). Childbearing decisions under such circumstances are complex, and women, as an adaptive strategy, often delay the milestones of their family formation. Meanwhile, new LC patterns can also be perceived as uncertain and risky, such as divorce, single-parent households or late childbearing (Blossfeld et al. 2005, Cooke et al. 2010). Youths undertake life events without any historical patterns to follow and take the risk of the "do-it-yourself" biography introduced above (Beck 2003).

Finally, biographical and cultural risks and insecurities can overlap with environmental and health risks, in the forms of viruses (Mansouri – Sefidgarbaei 2021), radioactivity or catastrophes. For my research, the health hazards of invisible and/or hazardous substances have high relevance. They are often beyond human perceptions and socially constructed in a sense that they only "exist" in terms of our knowledge about them, and we can only react to them individually or socially if we are aware of their existence (Lupton 1999). Meanwhile, when everything becomes hazardous around us, we tend to ignore the hazards. The anxiety of the highly educated individuals is not relieved by their knowledge since they are only even more aware of their inability to know "enough" about the different risks or how to control the exposure to the (cumulative) effects or cross-contamination. Though these substances are harmful to all humans, pregnancy and breastfeeding periods imply a high level of risk for women (Bellingham – Sharpe 2013, Beck 2003).

2.2.3   Timing of motherhood

To continue the train of thought of the gendered life courses, motherhood and its timing play a vital role in female life courses. The general phenomenon of postponed motherhood is a part of the radically changing life courses in developed countries from the 1960s. Reasons are

multifaceted.[9] Women's increased educational level and economic uncertainty (Mills – Blossfeld 2013, Lesthaege 2010), the introduction of contraception (England 2010), the lack of affordable housing (Mulder – Billari 2010), medical factors (Szalma 2021) all unambiguously had a strong postponement effect. The role of children in families also changed, and the decision to become a parent is now stronger depending on how childbirths influence the lifestyle and well-being of the parents (Liefbroer 2005). The duration and payment of parental leave are also an influencing factors because they are often conditional on employment and motivate women to establish a career before childbearing (Kalwij 2010). In sum, these factors all make study/work and being a mother intensely challenging for women[10], who, therefore, often delay their childbearing (Huinink 2013).

There are also long-term cultural differences in women's fertility behaviour. The East-West divide, the so-called "Hajnal line" (Hajnal 1947) is still apparent in Europe; women marry and become mothers at an earlier age in Eastern Europe (Paksi – Szalma 2009) and choose other partnership forms than marriage to an increasing extent (Billari – Mills 2013). However, the tempo of fertility postponement of women in CEE is relatively rapid and the gap between these two regions remains substantial (Mynarska 2010, Kohler et al. 2002). There has been an extremely fast postponement in Slovenia, the Czech Republic, and Hungary; meanwhile, countries in Southern Europe feature the most delay (Eurostat 2018).

Postponement is not only a shift towards motherhood in older ages. It concentrates fertility within a short life period – a phenomenon called as rectangularisation (Kohler et al. 2002). Higher educated women, therefore, have a higher probability of having a lower number (quantum) of them, which phenomena strongly contribute to the lower fertility rates. The low fertility in Eastern Europe is also attributed to the difficult and rapid social and economic changes and crises and the high levels of unemployment (Frejka – Sobotka 2008). Some argued that CEE countries would probably feature further postponement of childbearing, which would maintain the low fertility rate (Kohler et al. 2002, McDonald 2006). Meanwhile, some scholars suggest that lowest-low fertility is a transitional phenomenon (Bongaarts 2002) and the total fertility rates will start to increase if a country's GDP achieves robustness and/or when women's

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[9] There are several other theories regarding the timing of childbearing, such as the rational choice theory (Becker 1960), the theory of planned behaviour (Ajzen 1991), or value of children (Hoffman – Hoffman 1973) but they are well beyond both focus and the reach of the dissertation.

[10] This incompatibility is weakening with increasing age, by different degrees in European countries (Corijn – Klijzing 2001).

increased labour market participation is combined with adequate work-life balance (Goldstein et al. 2009, Luci – Thévenon 2010).

But what does postponement mean in terms of age norms? The timing of life events and how age norms influence individual behaviour and self-reflection play important roles in analysing LCs. Individuals have mental maps in their minds about life events forecasting in which period life events should be realised, or they are able to reflect if it happened too early, too late, or at the right time. Individuals internalise these age norms – have the "social clock" – and think and behave accordingly (Wagner et al. 2019). The subjective judging of timing is therefore not determined by only actual (biological) age, but rather by a cultural value pattern prescribing to individuals not just the timing but the sequence of life events, for example, women who had left school "a long time ago" or have been married for a "long time" and own a flat, are likely to feel it is too late for childbearing irrespective of their actual age (Tóth 1993). *"[T]he regulating power of age norms changes with time: the closer the perceived deadline, the more relevant it becomes for a decision-maker"* (Mynarska 2010: 370). The East-West divide is also present in Europe regarding childbearing age norms; the ideal timing of motherhood is considered at later ages in Western Europe than in CEE countries (Paksi – Szalma 2009).

3. PREVIOUS FINDINGS: Female professionals

This chapter introduces the international research findings on the WLB of female professionals.[11] All three parts of the chapter shed light on different aspects of the issue. The first part (3.1) introduces the conflicting overlap of career and motherhood of female professionals, including the timing of childbearing and some main constraining and facilitating factors of their WLB. Chapter 3.2 describes those characteristics of *STEM fields* that can further influence women's WLB, and finally, chapter 3.3 pays attention to the WLB of women PhD students.

3.1 Work-life balance

3.1.1 Work-family conflict

Despite the wide-scale research into the issue, women professionals have been still severely struggling with their WLB (Fox et al. 2011). Scholars have pointed out recently – using the life course approach – that family and career establishment overlap in professional women's life, which counts for the largest leak in the academic pipeline (Mason et al. 2013, Moen – Sweet 2004). Academia and parenthood are both greedy institutions (Coser 1974), for they demand exclusive and undivided time, energy, devotion and commitment from their members (Smidova 2016, Blair-Loy – Cech 2016, Ward – Wolf-Wendel 2012). Therefore, women's biological clock and tenure clock are in conflict with each other, and young mothers leave science with twice probability than new fathers do, particularly if they become mothers during PhD education (Cech – Blair-Loy 2019).

Women face incompatible expectations at the intersection of individual and academic life courses (Huopalainen – Satama 2019, Mavriplis 2010). *From a family perspective* – though new family models have been emerging (Takács 2019, Crompton et al. 2007) –, individual life courses still strongly prescribe the traditional female/homemaker model for mothers (Moen 2011). Even breadwinner women in top positions are likely to be responsible for family-related tasks (Szalma et al. 2020, Bomert – Leinfellner 2017). They have either less personal discretional time and fewer hours to spend on professional work that generates WFCs (Peng et al. 2011, Rothbard – Edwards 2003). *From the work perspective*, the academic career model

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[11] The introduction is based on a qualitative literature review using purposive sampling. It contains mainly empirical research outcomes, but also some related vital social theories. Regarding theory-driven WLB research studies, some of those are mentioned which consider gender dimension. The majority of the reviewed studies are Anglo-Saxon, because the issue of "Women in Science", particularly the WLB in STEM fields is less researched in Europe. Therefore, when they are relevant, European empirical studies are highlighted in the review.

hardly tolerates long career breaks (Lewis – Humbert 2010). This lock-step advancement roots both in the knowledge-intensiveness of science and in the career model that emerged in the 1950-60ies (introduced in the previous 2.2.2 chapter). Women both in the USA and European countries more often break their careers than their male colleagues due to caring responsibilities, while men take parental leaves only at very low rates (Hewlett et al. 2008, She Figures 2021). Moreover, women's WLB is particularly jeopardised by recent neoliberal changes that restructured and downsized higher education institutions (Rosa 2021).

One of the most conflicting life events of the intersection of academic career and family life courses is the timing of motherhood. On the one hand, age norms and women's biological clock draw a limit on the postponement of motherhood (Paksi – Szalma 2009). On the other hand, early career years are characterised by high work demands and job insecurity therefore women's tenure clock pressures them to delay childbirth until achieving tenure (Mason et al 2013, Jacobs – Winslow 2004). This phenomenon is also relevant in Europe, but fertility data of women in R&D is scarce in Europe. In the USA, wide-scale representative surveys showed that having a child before tenure track employment reduces women's chances of gaining tenure (by 20-25%), while the same fertility pattern affects men's chances of promotion only slightly, but positively. Women are married at around half the rate of their male counterparts and they are nearly three times more likely to be single without children. The proportion of single female professionals in STEM fields is around twice than of men's. Between the ages of 30 and 34, nearly half of men had children at home, compared with 32 percent of women. Only every third woman of those who took an academic career becomes a mother, and they are also more likely to have only one child. The most common age for women faculty[12] to have children is between 38 and 40 years of age (Mason et al. 2013, Jacobs – Winslow 2004). The ages at receiving PhD and tenure have been still increasing, and women delaying their motherhood till their late thirties can even face health risks and time- and money-consuming fertility treatments (Szalma 2021, Mountz 2016). Meanwhile, professional women are not always aware of health-related consequences (Hewlett et al. 2008).

In sum, women still cannot "have it all" yet. The ideologies of the ideal worker and the ideal mother of these greedy and gendered institutions still are in conflict (Currie et al. 2000). Some argue that women's career choices, life goals and decisions on life events can be mainly

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[12] University of California

explained by their personal preferences[13] (Hakim 2006), by the level of their devotion (Blair-Loy – Cech 2016), or by class-based career identities (Duncan 2005). Meanwhile, recent studies called the attention that individual preferences are always socially and culturally embedded, shaped, constrained and reproduced and women often had to choose options that are available, not options that are optimal for them (Castaño – Webster 2011, Hobson 2011). For example, the vast majority of professional women aim to get back in work (Hewlett et al. 2008), but young mothers consider continuing work in other less prestigious jobs or at less prestigious institutions instead, which are perceived as more family-friendly (Mason et al. 2013, Perna 2001). Even doubly privileged female professionals – working in high commitment careers in a family-friendly welfare state in Europe – tend to turn away from their promising careers and (are pushed to) follow mommy track careers (Thun 2020, Halrynjo – Lyng 2009).

3.1.2 Constraining and facilitating factors

What are those factors that highly influence the WLB of researchers? Early career, family-friendly, and non-tenure positions all tend to offer low secure positions in R&D (Ward – Wolf-Wendel 2012). The way of reaching tenure is marked by several fixed-term contracts for both genders at increasing rates but particularly for those of young mothers working part-time (O'Keefe – Courtois 2019, Ivancheva et al. 2019) and women of colour (Kachchaf et al. 2015). In Europe, precarious working conditions among researchers – who are in a couple with children – are more frequent in the case of women than men. Meanwhile, among singles, they are more typical for men (She Figures 2021). The disadvantageous labour market position often goes hand in hand with disadvantageous working conditions (Tight 2010). *Heavy workloads* and long hours in academic life seems to be a general phenomenon in Europe (Friesenhahn – Beaudry 2014), and also in the USA, where two-thirds of faculty work over 50, and more than one third over 60 hours (Jacobs – Gerson 2004, Mountz 2016). The pressure to *work harder and longer* also strongly stems from the boundless time cultures of greedy organisations especially in high-commitment careers (Coser 1974).

Professionals tend to internalise boundless time cultures of organisations, and, at the same time, want to meet the demands of family life, which often results in the feeling of the *time squeeze*

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[13] Hakim (2006) in her preference theory argues that modern societies provide women with options for family models and lifestyle that were not available before. She distinguished three groups of working and life-style preferences, as ideal types, into which women can be categorised according to their choices: home-centred, work-centred or adaptive.

(Kutrovátz 2017, Rafnsdóttir – Thamar 2013, Clarkberg – Moen 2001). *Time squeeze* can produce time-based work-life conflicts that can lead to strain-based conflict, stress (Bell et al. 2012), and burnout (Schuurman 2009). It also often generates more negative spillovers (Király et al. 2015) or greater illness (Dembe et al. 2005), as well as insomnia for women than men (Mountz 2016). Meanwhile, professionals (compared to service workers) can perceive higher negative spillover and lower work- and family-related stress at the same time, perhaps because they are more critical and sensitive regarding their own WLB (Grzywacz et al. 2002).

It is widely proved that *flexible working arrangements* (FWA) also play a vital role in women's WLB (Chung – van der Lippe 2020). Flexibility and autonomy are intrinsic motivators in academic work (Bellamy et al. 2003), especially if work can be completed regardless of time and space (Rosa 2021, Grant et al. 2013). FWA include working time autonomy (large freedom of schedule control), flexitime (a narrower term, where core hours constrain schedule control) and flexiplace (telework or homework) (Chung – van der Lippe 2020). The ability to control time can decrease work-life conflict and enhance WLB (Allvin et al. 2013, Hobson 2011), improve mental health well-being (Greenhaus et al. 2003) and the enjoyment of work, productivity (Shockley – Allen 2011) and innovative ideas among professionals (Dediu et al. 2018). Working from home can also decrease work-life conflict (Kelly et al. 2014), particularly for young mothers (Peters et al. 2009), who can even save travel time (Erickson et al. 2010) and can remain in their knowledge-intensive jobs with a greater chance (Fuller – Hirsh 2018).

Meanwhile, increased FWA in work not necessarily leads to greater life quality (Hobson 2011), and it is often viewed as a double-edged sword (Peters et al. 2009), regardless of whether it is employer- or employee-driven (Smith et al. 2008). *Firstly*, it often overstretches the working timeframe, resulting in never-ending working cultures described above: the more autonomy an agency has, the more workplace-related demand and the longer work hours s/he experiences (Szalma et al. 2020). Therefore, it is not surprising that professionals at job-intensive private companies that allow FWA experience more WFC than their counterparts at firms with scheduling rigidity (Blair-Loy 2009). *Secondly*, it highly blurs the boundaries between the life spheres – for professionals the most –, in the forms of frequent homework, receiving work-related contacts and communications (Glavin – Schieman 2012), and multitasking (Demerouti et al. 2014).

Thirdly, FWA also traditionalises gender roles and responsibilities (Cech – Blair-Loy 2014). While men are expected to use them in order to intensify their work in the hope of income premiums, women (are expected to) use it for achieving a better WLB (Van der Lippe et al.

2018). Some argue that the slow spread of FWA can be traced back to the issue of *devotion schema*, since those employees who use FWA are often stigmatised (Beddoes – Pawley 2014, Williams et al. 2013), considered to be less loyal to the workplace (Lundquist et al. 2012) and are marginalised (Ayre et al. 2013). As a result, female academics are afraid of seizing the opportunity for fear of the denial of their tenure appointment (Lester 2013). *Finally*, in the case of WFA, professionals are expected to manage and schedule their – usually project-based – work on their own (Tausig – Fenwick 2001, Kelly et al. 2010), and this personal control of *time shifts the responsibility to individuals*, who – though "free" to decide on how to prioritise roles –, remain alone in the struggle for WLB (Toffoletti – Starr 2016, Lewis et al. 2007).

Adequate scheduling, meanwhile, highly depends on how professionals can control the highly blurred boundaries between the roles of their multiplied life domains (Peng et al. 2011) High boundary control leads to better work-life balance, while low control negatively affects it (Kossek et al. 2012). But the way of how individuals manage the boundaries does not necessarily match their desires for boundaries (Rothbard et al. 2005). Professionals often have a strong preference for segmentation of life spheres but fail to achieve it. Female professionals, especially those with children, have lower boundary management control and worse WLB than men, and segmentation is also a greater challenge. Meanwhile, for integrator women, blurring time and space boundaries does not seem to pose a problem because having boundary control is a part of their strategy (Mellner et al. 2014). Info-communication technologies (ICT) can help to harmonise the tasks regardless time and space (Grant et al. 2013), but they also can blur the boundaries between work and home (Dén-Nagy 2013) and increase the expectation of long hours and is always available for the organisation (Nagy 2020, Mullan – Wajcman 2019).

3.2 Women in science, technology, engineering and maths (STEM)[14]

3.2.1 Low representation

Though some research envisions a decrease in gender equalities in academia (Morrison et al. 2011), the disadvantageous position of women is still an evident global phenomenon (Fox 2020). Statistics well show the horizontal and vertical segregations of women in science: women's presence in STEM fields is significantly lower than their male counterparts in social sciences and humanities (henceforth: SSH), and women disappear in low numbers at higher levels of the academic hierarchy (Xie et al. 2015). This phenomenon is described by the leaky

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[14] Empirical results in engineering are scarce, therefore the review focuses on STEM fields in general, but where possible, it highlights those few engineering-related cases.

pipeline metaphor[15], which compares an educational career to a pipeline, where women and other minorities lose members to a greater extent than their male counterparts as they progress through the pipeline, especially after receiving their PhD degree (Shauman 2017, Burke – Mattis 2007). The vertical segregation of women in the European Union is also significant, though it features a smaller gender gap than in the USA (She Figures 2021). Figure 1 below shows how the proportion of women students and graduates in science and engineering increases during tertiary education but starts to decrease after obtaining PhD. Regarding Grade A positions (professorship), only 18% of women achieved it in 2016. In other words, a larger pool of graduate students on its own would not be able to decrease gender inequality in these fields.

Paradoxically, women's proportion in STEM field does not go hand in hand with the level of gender equality in a country. It is called the gender-equality paradox (Breda et al. 2020), that those countries that feature high levels of gender equality also produce the largest gender gap in STEM fields both in secondary and tertiary education. Though women in these countries have more empowerment opportunities which help to engage them in STEM, they are less likely to choose STEM disciplines than their counterparts in less gender-equal countries, where lower life quality may pressure them to invest in education in well-paid STEM professions (Stoet – Geary 2018). Qualitative European research also called the attention to that nor higher gender awareness neither high concern for WLB lead unambiguously to a better gender balance in STEM fields (Godfroy-Genin 2009).

Figure 1.
Proportion of men and women in a typical academic career in science and engineering
EU28, 2013-2016
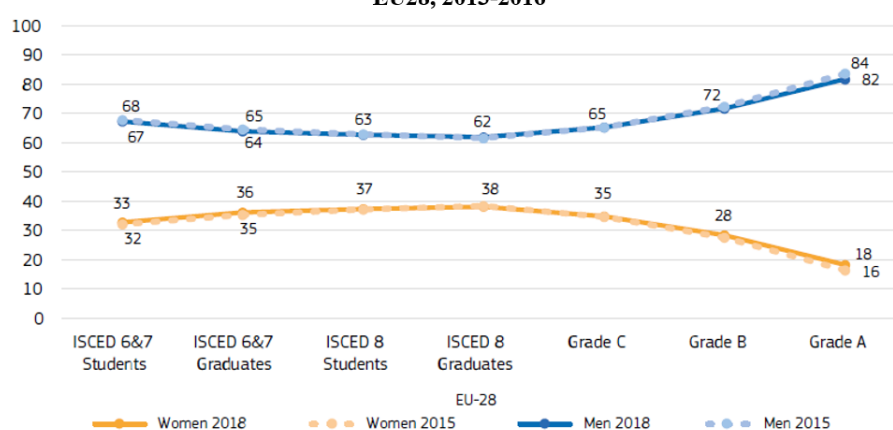
Source: She Figures 2021

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[15] The metaphor was used initially only for STEM fields (Berryman 1983), and was later extended to all fields of science, because vertical segregation of women is visible in non-STEM fields as well (Paksi 2014). The metaphor has been criticised by several scholars (for a short summary see Paksi 2014), but is still used widely. I use the metaphor as an umbrella term, as a synonym of "Women in Science" research.

3.2.2 Chilli climate

The reasons for women's low presence in engineering is multifaceted. Women's access to higher education was prohibited or limited by law and regulations till the cusp of the 20th century in western countries. The professionalisation of engineering was completed without the presence of women. Namely, women were not excluded but were not "allowed into a man's world" at all during the process (Watts 2009), for a much longer period than in medicine or law (Greed 2000). Along with the professionalisation of engineering was born the engineering elite with masculine identity: white heterosexual middle-class men with exclusive rights to technological knowledge, which was hardly reconcilable with femininity (Nagy 2014, Wajcman 2008). Women usually were and still have been considered more emotional and subjective compared to men, who seem to be more rational and objective, and therefore more suitable for "doing science" (Király 2005, Harding 1986).

This masculine view of science in the patriarchal system of the academic world – where women are in token positions – generates a "chilly climate" for women (Maranto – Griffin 2011). Education and employment in STEM fields are often catalysed by biases and negative stereotypes regarding women's attitudes to science (Ayre et al. 2013). There is especially a prejudice against women's knowledge and achievements: men mostly, but women also tend to evaluate male work more highly than a female's despite the same achievements[16] (Riegle-Crumb – Humphries 2012). This often leads to biased or discriminative practices (Maxmen 2018), which act through the hidden/gender biased curricula transmitting them through teachers (Lin et al. 2008), textbooks (Good et al. 2010), or mentors and supervisors (Dashper 2019). This chilly environment highly determinates women's socialisation in education, their WLB and the choice of career (Blickenstaff 2005, Jacobs 2005). It also contributes to the low self-confidence and motivation of women, who, in addition, they hardly find female role models with which they could identify and whom they could follow (Hayes – Biglerb 2013).

It is a general phenomenon that discriminative and biased structures and norms are taken for granted in STEM jobs; they are continuously legitimised and reproduced and women are expected to adapt to them (Drew – Canavan 2020,). Women often accept their token position in organisations and try to assimilate in order to be "one of the boys" (Kanter 1977). Their aim to "fit in" can be understood in an environment where only male masculine norms are likely to be

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[16] More on the Goldberg paradigm: Goldbeg 1968, and on Mathilda-effect: Rossiter 1993.

accepted (Hadas 2019). For example, women are often perceived to lack the qualities of successful scientists (Carli et al. 2016) and their achievements often remain invisible for male peers (Husu 2020, Faulkner 2009). The lack of acknowledgment usually thrives women to prove their knowledge in order to be accepted. In this way, they correspond with the "ideal scientist" model, but the pressure can easily result in overachievement and exhaustion (Gill et al. 2008). Assimilation also often generates role conflict between women's personal and professional identities (Hatmaker 2013): women in knowledge-intensive occupations usually develop a strong positive professional identity (Halrynjo – Lyng 2009), but they also have to develop personal identities that incorporate motherhood and career (Herman – Lewis 2012). Meanwhile, assimilation does not challenge the patriarchal system of the academic world; moreover, it reinforces and reproduces gender inequalities (Hughes R. 2011, Rhoton 2011).

Male environments can be particularly chilly for women when they are excluded from both formal and informal networks. Informal networks in science – the "boys' clubs" – ruled by men in both inside and outside of the organisations allocate benefits of information, friendship and social support for their members (Paksi – Tardos 2018, 2021; Van den Brink – Benschop 2013, Ibarra 1992). Though social support plays a dominant role in the retention of women in STEM fields (Barnard et al. 2010), women hardly gain membership into them (Phipps 2008), and if so, they are less able to be active members due to their family-related responsibilities[17] (Durbin 2011). Women often perceive men-dominated environments as aggressive and discriminatory (Davis 2001), in which women are often discussed and treated in a derogatory way (Powell et al. 2009). These gendered discourses reinforce the insider and outsider positions of men and women in networks, respectively (Watts 2009).

These non-supportive chilly environments described above constrain women's academic careers in various ways, but particularly how they can reconcile their work and private/family life. (Weisgram – Diekman 2017, Beddoes – Pawley 2014, Mavriplis et al. 2010). Women – particularly those of women of colour (Kachchaf et al. 2015) – are often **discriminated** based on their gender or parental status (Reuben et al. 2014, Settles et al. 2013). Their gender, marital and parental status and age further intersect (Crenshaw 1991) with the special characteristics of their knowledge-intensive profession and its male environments. Measures of success and

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[17] The younger male research generation has been socialised in a more equal domestic environment, therefore their networks show more gender diversity (Feeney – Bernal 2010).

devotion to the workplace have not changed with women entering into male professions. Long and intensive work hours, laboratory work and the rapid pace of STEM innovation also influence how new parents can reconcile career and family responsibilities (Blair-Loy – Cech 2016, Godfroy-Genin 2009). Women also face higher opportunity cost of childbearing in knowledge-intensive professions: there is a higher cost of their human capital gained by long education, and there are higher wages in these segments of the labour market, for example, in STEM fields, workers earn higher 26% more than in SSH (Langdon et al. 2011).

In sum, empirical results show that mothers in STEM perceive that WLB can be rarely combined with a sense of entitlement to sustain their career progression – nor in the USA (Cech – Blair-Loy 2019, Mason et al. 2013), neither in Europe (Herman – Lewis 2012, Godfroy-Genin 2009). Women are also less likely to receive organisational support for their WFB (Engler et al. 2021), and even face cultural beliefs indicating that they should seek family support instead of institutional backing (Cech – Blair-Loy 2019). These practices lead to the phenomenon that women tend to consider WLB issues as individual responsibility and they are less likely to seek support (Moen 2011). WLB-related difficulties highly contribute to dissuading women from pursuing careers in STEM fields and/or that careers of male partners of female professionals are prioritised within the family. In an executive summary on 3700 women leaving engineering in the USA, it was found that half of the women cited working conditions, too much travel, lack of advancement or low salary; every third woman reported a chilly workplace climate, and every fourth woman the need for having more family time, as reasons for leaving. Interestingly, women engineers working at family-friendly organisations, also perceived WFCs (Fouad – Singh 2011).

3.3 PhD students

The majority of the research before the millennium focused on those structural and institutional factors of graduate education that affect the successful completion of the PhD degree, such as socialisation, time, mentoring or fellowship (Bieber – Worley 2006). Only recent research has been targeting the role of gender (Sallee 2010) and personal and academic background (Nettles – Millett 2006). This chapter focuses on the WLB of PhD students: firstly, in all fields of science, then on the timing of childbearing, finally on STEM fields.

3.3.1 Work-life balance

Universities are especially greedy institutions for female PhD students (Currie et al. 2000), for they have to socialise in a way that makes them be ideal students and workers (Mountz 2016).

The attrition rate is typically high both in the USA and Europe, and women are much more dissuaded from academic career than their male counterparts (Beddoes – Pawley 2014, De Welde – Laursen 2011). Based on Anglo-Saxon empirical findings, research shows that married female graduate students with depending children are usually less satisfied with their WLB, which decreases their confidence in obtaining the degree. Men, at the same time, have more confidence in it (Mirick – Wladkowski 2020). Time demands and the juggling of multiple roles (full-time work and caring) as well as the strong demand of PhD-related teaching obligations are the most hindering factors women experience in doctoral schools (Brill et al. 2014, McAlpine, et al. 2009, Smith et al. 2006). The culture of overwork makes WLB problematic and unsustainable during PhD education for both genders, but particularly for women with family responsibilities (Schuurman 2009).

Balancing school, work and family life is full of *stress* for female students, regardless of their marital status (Stimpson – Filer 2011). They experience less support and more stress than their male counterparts (Aitchison – Momwbray 2013), including tiredness, burnout, anxiety or depression (Carter et al. 2013, Jairam – Kahl 2012, Leonard et al. 2005), and in some cases, nervous breakdown (Mountz 2016). They try to find a balance through managing time and stress levels, maintaining mental and physical health, creating personal time, finding financial and emotional supports (Martinez et al. 2013). Those who are insecure financially have less time for family or personal interests and struggle more to adapt to the university environment (Peters – Daly 2013). The *time-squeeze* can force them to use time productively and efficiently; meanwhile, their time management is managed on a daily basis instead of planned time management (Byers et al. 2014, West et al. 2011, Ford – Vaughn 2011). They also try to construct boundaries to balance their life domains – typically a work–home separation – in order to be able to focus on paid work (Long et al. 2018).

Mothers are often torn between their roles and frustration and anxiety can overwhelm and erode their confidence, resilience and productivity (Aitchison – Mowbray 2013), and also their emotional and physical well-being (Haynes et al. 2012). As a coping strategy, they also try to perceive childcare as a safe place for their children. Some others drew strength from their academic work, which satisfies them intellectually. Their mobility is constrained or even impossible in terms of attending conferences, which results in women's lower level of embeddedness in science – an obstacle that male graduate students experience much less (Brown – Watson 2010, van Anders 2004). They sometimes seek support from inside, from tutors and fellow doctoral students (Cockrell – Shelley 2011), and also from outside the

academy, from family, children, partners or spouses (Byers et al. 2014), but they often lack systemic supports (Mirick – Wladkowski 2020, Springer et al. 2009). Parent PhD students tend to avoid discussing the challenges of parenting openly, for they would be perceived by others as less committed professionally (Armenti 2004). In sum, PhD students with family or dependents can hardly meet the demands and consequences described above and often do not want to continue the all-consuming lifestyle and sacrifice other important fields of their life (McAlpine et al. 2012).

Those few European research studies that focus on PhD students also deal with mainly attrition issues, partly including their well-being. In Spain, the most frequent motives and reasons of women for dropping out of doctoral education (education, economics, psychology and law) are the struggles for WLB and problems with socialisation (Castello et al. 2017). In Finland, a clear relationship was revealed between problems with well-being (stress, anxiety, exhaustion) and plans for leaving PhD studies in arts, medicine, and behavioural sciences (Stubb et al 2011, Pyhältö et al 2012). In Belgium, based on a large-scale survey, Levecque and colleagues (2017) showed that PhD students had a significantly higher risk of having or developing depression compared to other higher education students, employees, and the general population. Their mental health problems were linked to work-family problems, job demands and control, and to career perceptions outside academia. Finally, focus groups with Swedish mother PhD students in different fields of science reassured that the well-being of PhD students' was torn between their multiple roles. In addition, they were financially dependent on their partners, who covered the loans for housing and expenses for children. They felt time pressure and stress, but flexibility in working hours slightly enhanced their WLB. They often prioritised their studies, which negatively affected their well-being and private life (Schmidt – Umans 2014).

3.3.2 Timing of childbearing

In the last decades, there has been an increasing tendency in the average age of PhD students. The older doctoral students are, the higher the probability they have family-related responsibilities, and the impact of family on women's degree progress is becoming increasingly important (Lee et al. 2009, Brus 2006, Maher et al. 2004). The average age of women at first childbirth is over the age of 30 in most OECD countries and is between 28-30 only in eight countries, including the USA and Hungary. Women with higher education become mothers even at later ages, well into their thirties in developed countries (OECD 2020).[18] In the USA,

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[18] Other exceptions: Chile, Latvia, Lithuania, Poland, the Slovak Republic, Turkey.

large-scale research showed that the average age at obtaining a PhD was 33.4 for men and 35.5 for women around the millennium (Mason et al. 2013, Jacobs – Winslow 2004). Completing a PhD degree takes a longer time in SSH fields than in STEM (Weidman et al. 2001), and for those who undertake work during PhD it takes longer to complete the degree (Salle 2010). At the same time, the majority of female PhD students agreed that ages between 28-34 would be the ideal time for them to become mothers. As Mason phrased it: *"They can see their biological clocks running out before they achieve the golden ring of tenure"* (Mason 2009: 2).

Many studies report that being married or a mother delays the PhD completion for women (Mirick – Wladkowski 2020, Gardner 2007). In the USA, around every fourth student lives with children under the age of six or other dependents (NSF 2019), and for male and female students with dependents, it took 1.5 and 2.2 years longer to obtain the degree, respectively (Nerad – Cerny 1993). The timing of PhD studies for women was found to be a source of stress (Brown – Watson 2010), and these experiences push many women away from even considering postgraduate studies (Thanacoody et al. 2006, White 2004). Social policies also influence the timing of childbearing of PhD students. In the USA, graduate students are eligible for six weeks of maternity leave only if they worked one year in full employment before delivery. Only 3 percent of institutions provide paid leave for graduate student researchers without any limitations (Mason et al. 2013). It is worth considering that 58% of female PhD students did not want to become a mother during PhD studies due to time demands (76%), income problems (61%), PhD demands (59%), stress (58%), availability and affordability of childcare (56) and housing (52%), incompatibility of PhD and childbearing (54%), while 21-23% of them were afraid to be perceived as less competent to obtain the degree or in future employment (Mason et al. 2013).

In Europe, a career tracking survey of doctorate holders[19] (ESF 2017) found that nearly 78 % of PhD holders completed PhD education within 4-6 years.[20] The first EURODOC survey focused on doctoral candidates in twelve European countries[21] (Ateş et al. 2011). Its results showed that more women took parental leave before PhD completion in Croatia and the Scandinavian countries (11-16%) than in the rest of the countries. There were more male than female single students. With two exceptions (Finland and Slovenia), females were more likely

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[19] Two surveys were carried out altogether in 8 countries (Switzerland, The Netherlands, Germany, Romania, Croatia, Luxembourg, Austria and France.

[20] Difficult to compare this data with the USA, where the 7.5 years on average included all graduate education.

[21] Austria, Belgium, Croatia, Finland, France, Germany, Netherlands, Norway, Portugal, Slovenia, Spain, Sweden.

to be divorced (or widowed). Finnish and Swedish students were more likely to be parents (30-33%). Male candidates (28-77%) felt remarkably higher pressure to postpone having children than women (16-65%), and the pressure was higher in the family-friendly Nordic countries. Women PhD students are less likely to be on full pay during parental leave in Austria and Germany (8-10%), while this is more likely in the Netherlands, Norway, Portugal and Slovenia. Doctoral candidates who taught and researched more than 21 hours a week beyond their PhD tasks were almost exclusively women. The maximum duration of PhD was more strictly limited in East European countries (Croatia, Slovenia) than in western countries. Women felt disadvantaged in their academic careers because of their gender (40-61%), while men thought it even more substantial (70-92%).

3.3.3   Science, technology, engineering and maths (STEM)

Research studies on STEM PhD students also tend to focus on attrition-related problems, and though the key role of WLB in the successful completion is quite often cited, even qualitative studies tend to focus on other – also important – obstacles, such as the lack of social support and a sense of isolation. In quantitative studies, personal factors also are handled as secondary and often fail to distinguish by gender. Studies focusing on engineering are more than scarce, let alone examining WLB in detail. In the following, a small selection of research is introduced which focuses on PhD students, STEM and uses the gender dimension.

In the USA, Hughes (Hughes et al. 2017) carried out 48 in-depth interviews with PhD students in STEM doctoral programmes. More than half of women students perceived that women in academia faced gender-specific challenges: sexism and the difficulties in family formation. They put extra effort into their work beyond the level that was expected of men; meanwhile, women were perceived by faculty to be less suitable to pursue a STEM career. De Welde – Laursen (2011) carried out 28 interviews with unmarried and childless men and women in six different STEM fields. Before being enrolled in PhD school, women were aware of gender stereotypes and segregation, but reported high levels of support and life-long interest in science. During PhD education they experienced overt sexism and the phenomenon of the old boys' club. They also missed role models: it would have been important for them to know other women who were juggling multiple responsibilities.

Lott and colleagues (Lott et al. 2010) used discrete-time event history analysis over a 20-year period to model doctoral attrition for 3614 doctoral students in 56 STEM departments. The odds of attrition were greater for females and for those who belonged to hard-applied science majors (such as engineering or computer science). Married students had a higher retention rate, which

may refer to the positive role or spousal support during enrolment. The need for social support to decrease stress was highlighted in other studies (Holahan 1979, Byers et al. 2014). Ülkü-Steiner et al. (2000) and Kurtz – Kostes et al. (2006) surveyed and interviewed 734 doctoral students and repeated the inquiry two years later in the same departments. The authors grouped male-dominated and non-male-dominated disciplines regardless of their field of scince. Women in male-dominated departments perceived their environment as less sensitive to family issues. Women had a lower academic self-concept of competencies and a lower career commitment at all points of their studies. Parents were equally represented in the samples and they perceived less peer support but higher sensitivity to family issues in the departments, and they had higher career commitment than nonparents – regardless of gender balance in the departments. This result is in contrast with other findings, which reported that married or parent students were often viewed as not strongly committed to their studies, or as unreliable and who were not worth the investment, while father students did not face the same biases (Xie at al. 2015).

Golde (2005) examined PhD students who left science (geology and biology) and humanities (history and English). Based on 58 interviews he found that while students in humanities had problems with the different ways of thinking about the discipline compared to at the undergraduate level, in science, students faced unexpected and unappealing workloads. They also found faculty life unbalanced, work-centred, and stressful, and they left because of their poor WFB. Science students also experienced incompatibility and a lack of support from their advisors. Gardner (2007) interviewed 20 male and female PhD students in the field of chemistry and history. WLB occurred as the main theme; for history students (who were older and had families) the balance occurred between their teaching and own coursework, while for chemistry students, the long hours spent in the laboratory caused an imbalance in their private life.

Cabay and colleagues (2018) identified incidents during PhD studies that weakened female doctorate students' identities as physicists or engineers. Based on 28 interviews, she found that the social environment was less than supportive for women and alienated many of them from doing science. They were often ignored by male peers and colleagues, either professionally and or socially, and perceived microaggressive communications from them devaluing their ability as scientists. These women also complained about the lack of empathy in departments for personal or family problems, and the only young mother in the sample described she forewent conference participations, and childbearing delayed the completion of her PhD research.

Finally, in Europe, a survey carried out in Denmark (Kolmos et al. 2008) with 399 PhD students found that 80 percent of engineering, science and medicine students worked during weekends

and holidays due to time pressure. For more than half of them, work became an activity for leisure time. The authors did not find gender differences regarding the satisfaction with the working environment.

4. HUNGARIAN CONTEXT

4.1 Work-life balance

Before the political system change, work used to be guaranteed by the state, unemployment was at low levels and there was a lack of democratic control over social insurance. On the one hand, men worked full time and had secondary jobs, while women also held full-time jobs and were almost exclusively responsible for all household and family tasks and had access to state-funded childcare institutions. On the other hand, long parental leaves available for mothers promoted caring work, which pushed women back to domestic chores (Szikra – Tomka 2009, Sobotka 2008). They seemingly had the freedom of choice and a good WLB in the late socialist period – called optional familialism –, that allowed female professionals to have both children and a career (Fodor et al. 2002, Nagy 2010). However, traditional family and gender norms were not challenged. Women's increased labour market activity was different in Hungary compared to western countries, where it went hand in hand with women's emancipation processes (Nagy et al. 2016, van der Lippe et al. 2006). As a result, women neither received support, nor did they seek it for their WLB; considering it as their own responsibility.

After the political system change, post-soviet countries faced the shock of rapid changes in the labour market and family formations and faced increasing insecurity and uncertainty (Sobotka 2008). Regarding social policies, there was a clear process of re-familisation in Hungary (Saxonberg – Sirovátka 2006). Though the length of parental leave was reduced due to economic crises in 2008, it was soon restored (from two to three years), in addition, public expenditure on childcare institutions was reduced, and the caring and full-time motherhood benefits were introduced (Fodor – Kispéter 2014, Gregor 2016). It was a paradox that although these attempts aimed at fostering WLB, they partly contributed to the strengthening of traditional family and gender roles and attitudes (Bari – Róbert 2016, Nagy et al. 2016) and contributed to the slight decrease in women's labour market activity (Fodor – Balogh 2010). Women have remained the primary caregivers and responsible for household tasks (Ukhova 2020, Acsády et al. 2012), while men have not been encouraged to share this work (Takács 2008). This backlash against women's emancipation still hinders women's career advancement, especially those of the higher educated (Nagy 2009, Křížková et al. 2010). In sum, in Hungary, we can observe a shift from the early 1990s, when women could "have it all", to the mid-2000s, when they have felt the pressure to choose between work and family (Schadt 2011).

Hungary after the millennium – in international comparison –, still scores very low at the measure of egalitarian gender culture and egalitarian work-family arrangements, and scores

high at WFC (Bornatici – Heers 2020, Neményi – Takács 2016). They experience insecure employment, long hours and low wages (Hobson et al. 2014, 2011) and low schedule control (Chung – van der Lippe 2020). Hungarian parents, especially mothers, have low expectations about their WLB opportunities, for they got used to experiencing stress and work-family interference, supposedly due to the prevailing traditional social roles of post-soviet legacy, including the lack of workplace sensitivity to family issues (van der Lippe et al. 2006). Hungary (and Ukraine) also have the lowest level of subjective well-being. Having a full-time job is needed for a better quality of life in post-soviet countries, which may explain why even available part-time jobs are not favoured by mothers, unlike in western countries (Bari – Róbert 2016).

4.2 Childbearing

As we can see above, long parental leave arrangements have a long tradition in Hungary.[22] Though new regulations in 2012 – such as fully paid five-day paternity leave, the option of part-time employment for mothers returning from parental leave, parents can work while receiving family allowances after their child reaches the age of one year – may foster fertility, recent pronatalist social policies – such as long parental leave or huge loan opportunities for newly-weds and young parents, the omnipresent lack of sufficient childcare services and part-time work opportunities – reinforce traditional roles (Nagy 2009, Neményi – Takács 2006). Though it lessened after the millennia, the majority of society still consider age of three of the child or even an older age before which mothers should not return to their work (Makay 2018, Blaskó 2011). Consequently, childbearing has the highest negative impact on women's labour market activity in Hungary among EU member states (She Figures 2018). At the same time, the proportion of fathers taking parental leave is less than 5% (Füleki et al. 2018), and fatherhood almost exclusively increases men's labour market activity (Nagy 2009).

Attitudes of higher educated women towards family roles are also twofold; Gregor (2016) found recently higher proportions of those of sharing egalitarian attitudes regarding household chores, and also higher proportions of those of considering family life and motherhood role as primary fields of their life (compared to lower educated). Nevertheless, even breadwinner women in Hungary also tend to undertake a greater share of household chores (Neményi – Takács 2006), and even female professionals having career aspirations are often judged negatively if they

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[22] Recently, 24 weeks of maternity/faternity leave and 136 weeks of parental leave. To become eligible for maternity leave, at least a 180-day active labour market position is needed within two years before giving birth. Students in higher education became eligible for maternity leave from 2015, after my fieldwork.

violate the norms widely shared by society, and are therefore often discouraged from forming a family (Sobotka 2008).

In spite of the slowly changing traditional attitudes mentioned above, socio-demographic changes that characterise the second demographic transition reached Hungary already before the 1990s (Tóth 2002). Hungarian youths also postpone the events of leaving the parental home and marriage – trends that also contribute to the delay of motherhood (Pongráczné 2012). Meanwhile, this postponing behaviour seems to have stabilised around the age of 30 recently (Spéder 2021).

The total fertility rate drastically dropped to well below replacement level by 2011, and since then, it has been slightly increasing (1.5 in 2018, OECD 2021, Billari 2008). Similarly to Europe, there is also a mismatch between the generally higher reproductive intentions and lower actual fertility rates (Spéder – Kapitány 2014). The chance of realising fertility intentions is significantly lower in post-socialist countries than in western ones. It is probably because of the unfavourable financial situation and also the *"discrepancy between slow value shift and the increased dynamism of structural changes."* (Spéder – Kapitány 2014: 393). The dominant two-children family model of the 1980s has been unravelling; the proportion of those who want one or three children has increased (Spéder 2009). The level of childlessness is also increasing: the highest is among higher educated women, regardless of age cohorts (Szabó 2019). Intentional childlessness does not correlate positively with educational level, but qualitative research explored links between higher educated women and voluntary childlessness (Szalma – Takács 2018).

Individuals have firm opinions on the "ideal" and "too late" ages for motherhood (Paksi et al. 2014). In Hungary, as in other East European countries, individuals set the age norms of childbearing at younger ages, which clearly shows the prevalence of the Hajnal-line (Paksi – Szalma 2009). Mynarska (2010) in Poland found the age of 30 as the most frequently perceived culturally defined deadline of motherhood. In Hungary, the age of 25 was "ideal" to become a mother[23], while "too old" for (another) childbearing was the age of 39 (Paksi – Szalma 2009). These age norms are set typically earlier than actual childbirths; the average age of mothers at their first childbirths was 27.7 in 2014 when my fieldwork was carried out (Eurostat 2021). Higher educated women postpone their motherhood beyond the age of 30 (KSH 2013), and

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[23] Hungary also ranks among the latest to marry, regarding both age noms and actual ages (Kamarás 2005).

they also typically have a shorter transition to second childbirth than their lower educated counterparts (Bartus et al. 2013).

4.3 Engineering and PhD education

Research and Development Research in Hungary is mainly conducted in public research institutes that used to belong to the Hungarian Academy of Sciences (HAS). The 15 research institutes and centres now belong to the Eötvös Loránd Research Network established in 2019. The other pillars of research work are mainly public universities. Research institutes and other companies in the private sector constitute the third pillar of research.

Though women's participation in R&D in Hungary increased by 12% in the last decade, their proportion compared to men had already started to decrease before 2010 and now is at a lower rate (30%) than the EU average (Table 1.) The majority of men work in the business sector, about five times more than women. The majority of women work in the higher education sector (KSH 2019). While the proportion of women holding Grade A academic staff positions increased in the EU member states (up to 23.7% on average), it decreased only in Hungary (from 24.1 to 20.1%) (and Spain) between 2013-2016 (She Figures 2018).

Hungarian women researchers, similarly to their western counterparts, also are exposed to higher labour market uncertainty than men. In higher education in 2019, for example, they are more likely than men to be part-time workers (men 8%, women 20,1%), or are employed on precarious contracts at a higher proportion (men 9,1%, women 16,3%). The gender pay gap is also vital; women researchers earned 17% less than their male colleagues in 2014 (She Figures 2021).

Table 1.

Proportion of women researchers in R&D		
	EU	HU
2006	30	33
2015	33,4	30.8
2019	33,9	30

She Figures 2021, Eurostat 2021

Engineering The reasons for women's low participation in engineering are multifaceted as was introduced in chapter 3.2. National *historical contexts* are also explaining factors. While women were allowed to participate in engineering higher education in Europe, firstly in 1871 in

Switzerland, Hungarian women had to wait until 1946 to gain equal rights with men to enter.[24] The new economic and political ideologies of the socialist regime that emerged after WW2 pushed women into engineering and industry. Chemical engineering was the most popular major – women's proportions often exceeded 50% –while only a few women attended courses in electrical engineering. This situation has hardly changed since then. Women's high proportion in chemical engineering can be partly traced back to the fact that women were allowed to attend universities from 1895 – but only in the fields of health, pharmaceutical sciences and humanities – and women could learn chemistry within their studies in humanities. During WW2, they were also allowed to attend lectures and laboratory practices of the faculty of engineering (Palasik 2003).

The favourable tendency in women's proportion in engineering *undergraduate* students had started to decrease after its peak of 25% in 1966. It was definitely interrupted by another political system change in 1989, and the privatisation reduced the demand for R&D professionals in general and for women in engineering in particular (Fábri 2008, Palasik – Papp 2007). The proportion of women undergraduate students fell below 15%, but the expansion of the educational system in the 1990s increased both the number and the proportion of women (24%, Palasik 2003). Due to the structural change in higher education in 2012, the number of state-funded fellowships was decreased in fields dominated by women (economics, legal and social science studies) and increased in STEM fields. However, women's proportion in engineering has been continuously decreasing and is lower than 60 years ago (KSH 2021).

Regarding the proportion of women *doctoral graduates* in all fields, it has been decreasing (Lannert – Nagy 2019) after an increase between 2006-2016 (from 42.1 to 46.9%). In engineering, the decrease had started earlier and women's proportion was only 20% in 2016. Meanwhile, in the field of ICT (Information and Communication Technologies) women's proportion has almost doubled but is still below 14%. Table 2. below shows how Hungarian data lags behind the EU level in both fields.

Table 2.

	All fields		Engineering		ICT	
Doctoral graduates in the EU and Hungary						
	2007	2016	2013	2016	2013	2016
EU	45.9	47.9	25.8	29	21	21
HU	42.1	46.9	22.4	20	7.7	13.6

She Figures 2018

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[24] At the end of WW1, women could enter for few months, but they were banned again due to the political system change in 1919 (Palasik 2003).

The low proportion of women researchers in R&D in STEM fields is also tangible. In 2017, it was only 1.4% in the total labour force, while men were present at a three times higher rate (4.1%) (in the EU, 3.1% and 4.5%, respectively) (She Figures 2018). The most researcher work in the field of engineering in R&D: women's 23% and men's 46.2%. The proportion of women is around 17% in engineering, which means that almost every fourth woman works in a field that features the highest gender inequality (Table 3).

Table 3.

Number of researchers and women's proportion in Hungarian R&D by fields, 2019			
Field	**Men**	**Women**	**Women (%)**
Engineering	15758	3289	17.3
Chemical	*219*	*99*	*31.1*
Electrical and informatics	*5963*	*651*	*9.8*
Natural sciences	8853	2949	25
Agricultural sciences	1110	827	42.7
Health sciences	3296	2648	44.5
Social sciences	2915	2598	47.1
Humanities	2168	1965	47.5
All	**34100**	**14276**	**29.5**

KSH 2019

In the last decade, engineering was financially the most supported field within R&D, 60% of all the investment was spent on the sector – particularly on electrical engineering, informatics and chemical engineering in the private sector (KSH 2019). At the same time, women engineers tended to leave the private sector to go to higher education and the governmental sector between 2006-2015. In 2015, women were present in only 17% in the engineering business sphere (She Figures 2018, see Table 4. below). Finally, women represented only 2.9% of the members of the Hungarian Academy of Sciences in 2019 in the field of engineering (MTA 2019).

Table 4.

Proportion of women engineers in Hungarian R&D by year (%)			
Sector	**2006**	**2008**	**2015**
Higher education	19	18	24
Public research institutes	20	34	26
Business	21	22	17

She Figures 2018

PhD education Doctoral schools operate within higher education institutions. Until 2016, doctoral education consisted of six semesters that were to be completed within three years. It included two phases. The doctoral course of credits took two years in full-time or longer in part-time form. It could have been prolonged with an additional year. After taking a comprehensive exam ("szigorlat"), students could go for the candidacy phase, which consisted of individual research work and the elaboration and public defense of the doctoral thesis. This one year in the

second phase could be extended by one more year. Recently, doctoral education comprises altogether eight semesters, completed in four years. and can be lengthened up to nine years. In 2009, PhD holders needed 7.5 years on average to complete and receive the degree (KSH 2011). Consequently, receiving a PhD degree typically occurs between the ages of 30 and 34.

There are still no systematically collected statistics on doctoral schools, students or doctorate holders in Hungary, therefore it is not possible to give a fully accurate account of their main characteristics. The number of state-funded PhD scholarships are limited and also are not sufficient to become financially independent, leave the parental home or establish a family. To cover doctoral education fees and receive some income, PhD students often take up assistant lecturer/researcher or other positions. In certain STEM fields (e.g., engineering), they tend to take jobs at private companies in order to gain professional experience and a higher income.

4.4 Previous findings

4.4.1   Work-life balance

Research on academics is still scarce in Hungary. In the last two decades, empirical research highlighted the main characteristics (Bukodi et al. 1997, Angelusz et al. 1998), labour market opportunities (Fábri 2002, Fábri, I. 2008, Inzelt – Csonka 2018), life paths (Pálinkó et al. 2010) of doctoral holders, and a few studies also dealt with the issue of the brain drain (Fényes et al. 2020, Csanády – Személyi 2006). The issue of gender inequality gained some attention when the low representation of women in academia[25] had been addressed in the domestic literature (Haraszthy – Hrubos 2002). The situation hardly changed, and studies have still been claiming attention (Pető 2018, Acsády 2010, Lamm – Nagy 2019). Few empirical investigations aimed to explore the barriers for women in science, but the issue of WLB – one of the main obstacles – has been addressed neither exclusively nor deeply.

A representative survey of 1271 PhD holders (Schadt 2011) examined the reproduction of barriers to women's careers. Almost four times as many women mentioned family reasons as barriers to their career than men. Men perceived less gender equality, while women more gender-based negative stereotypes and discrimination, such as lower income, evaluation of their knowledge, achievements and promotions. At the same time, women considered individual and personal reasons behind inequality instead of structural barriers. Twice as many women were single or divorced than their male counterparts and women also reported that they offered more

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[25] In the Hungarian language, the word 'science' includes all fields of sciences, both in STEM and SSH fields.

support to their partners than they received from them. Fényes (2017) further concluded that women were less satisfied with their private life and needed a better socio-economic background to achieve academic efficiency. Men's careers were faster than women's and had better chances of being promoted. Lanner and Nagy (2019) also pointed to the lack of gender approach, even gender blindness or anti-gender attitudes in higher education.

More recent research carried out five focus groups on the career and WLB of PhD holders (Tardos – Paksi 2020). The authors revealed some gender differences in the perception of WLB: women put a greater emphasis on individual coping strategies than men, who rather mentioned social norms, expectations, and attitudes concerning the issue. Men even mentioned women's responsibility in not choosing between work and family. None of the genders were aware of the role of equal opportunity or family-friendly policies in WLB, partly because the equality of their organisations were rather formal documents (Tardos – Paksi 2018, 2021). Women also experienced gender-based discrimination at job interviews and at the division of working tasks. This is in harmony with other findings in Hungary: gender-based discrimination is amongst the five most frequent reasons in the country (Neményi et al. 2019).

4.4.2 Science and engineering

Szántó and her colleagues (2008) quantitatively examined the barriers for women faculty in the field of health sciences and engineering in two universities. Results showed that men were twice more likely to be principal investigators of research projects, winners of grants and conference participants. They were also more prolific writers and scarcely supported their female colleagues' careers. Meanwhile, both younger and older generations considered the role of a supporting family background important in achieving academic success.

A supporting family was also found to be important in Schadt and Péntek's research (2013), who examined career opportunities, experiences and attitudes of women researchers working in the industry in STEM fields in a smaller sample. Based on six individual and two group interviews, they revealed that WLB plays a stronger role in the career choices of women than of men. Women perceived better WLB opportunities in tertiary education than in the private sector, though they were aware of the double-edged sword, namely the advantages and disadvantages of flexible working conditions in academia. At the same time, they described their masculine environment as less supportive, for example, where women had to be more efficient to gain professional acknowledgment.

A recent online survey (Alpár et al. 2019) filled an important research gap by surveying 1535 PhD holders under the age of 45. Results showed that WLB is a greater challenge for women than men. For example, between the age of 31 and 35, women were more likely childless (72%) than men (60%), and women delay their childbearing due to their PhD studies. Every fifth young academic reported negative discrimination based on family status – three quarters were women –, and this ratio was significantly higher in the field of engineering, health sciences and chemistry. Furthermore, while a high proportion (28%) of women reported discrimination based on gender, gender identity, ethnicity or disability, this ratio was only 4% for men, and the highest was in SSH fields (18%), while 8% in STEM fields. This research also pointed out that vertical segregation of women researchers starts already before the age of 45, which reassured the authors that intervention points should target the younger research generation immediately.

Takács (2020) interviewed 32 top women academics[26] in both STEM and non-STEM fields who were members of the Hungarian Academy of Sciences. She examined their identities and attitudes towards family and gender roles. She found more women in STEM fields who considered the second shift as an exclusively female task, but at work they identified with male roles and rather assimilated into the environment. They tend to emphasise the meritocratic feature of science, which did not allow gender discrimination in their field. It was a contradiction that in parallel with this, they perceived that women had to work more for professional acknowledgments than their male colleagues, and neither did they seek support for their work, nor did they consider that it was the role of the Academy to provide support.

Fifty individual interviews with social scientists and engineers further deepened the knowledge in another recent qualitative research (Engler et al. 2021). Women academics identified similar barriers to WLB than their colleagues abroad: time squeeze and exhaustion. Engineers were less likely to experience overburden than social scientists, whose low income tended to force them to undertake extra jobs. Researchers tried to ease the burden and work-life imbalance with different strategies, such as adequate scheduling and parental and spousal support – engineers also mentioned using paid help at home.

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[26] All had DSc degrees (a title that is awarded only by the Hungarian Academy of Sciences), which is quite similar to an A grade professorship.

4.4.3 PhD students

In Hungary, there are only a few regional studies that focus on the WLB of PhD students. Ten in-depth interviews with female PhD students in humanities (Tornyi 2007) highlighted how the support and motivation of high school teachers accelerated students' PhD enrolment, but when being enrolled, only one student aimed to become a researcher and take on the WLB-related difficulties she foresaw in her researcher career. The others emphasised their primary traditional family roles and responsibility and explicitly stated that they would/will give up their career for the benefit of their family and husband. Tornyi concluded that PhD students had two strategies for reconciling studies and family: they postponed career and had their child first, or – in the majority of the cases – followed the lock-step advancement and postponed childbearing till finishing school.

Fináncz (2007) investigated both career and private plans of PhD students belonging to various disciplines at the University of Debrecen. The results showed young researchers also want to "have it all": establish a family and fight their way up in the academic hierarchy. One-fifth of the students already had children at the time of the research, another fifth, however, did not find children an essential part of life, and 2% clearly rejected the idea of having children. Students in her research also postponed or did not plan family formation due to financial or career-related reasons, and women also had difficulties in finding a partner.

To my best knowledge, empirical research has not yet investigated the WLB (or else) of engineer PhD students in Hungary. In engineering, only pioneer research on undergraduate engineers (Takács et al. 2013) examined both students and faculty with mixed research methods. The issue of WLB among women engineers was taken seriously; they already counted the years in which they could become a mother at a young age and establish a stable career before childbearing. Meanwhile, teachers significantly formed students' attitudes by disseminating very traditional family and gender roles. The actors did not even perceive gender inequality in the university; moreover, some teachers concluded that career and motherhood just cannot be reconciled in engineering and IT professions. Hardly any of them thought that this situation should be changed (Nagy 2014).

5. RESEARCH QUESTIONS

Based on previous findings introduced above, the WLB of young female professionals is constrained in multifaceted ways, particularly in STEM fields. Female PhD students are often characterised by low status, insecure labour market positions, financial difficulties, and high workloads. They also face constant productivity, deadline, and peer pressure (Kurtz-Costes et al. 2006). In addition, they belong to age groups with a higher probability of having (planning) family responsibilities and children (Mason et al. 2013). Their multiplied roles and precarious learning and working conditions may make women's WLB even more complex in the Hungarian context, where lower gender awareness and equality go hand in hand with traditional family and gender norms transmitted from both home and institutions (Gregor – Kováts 2019). It is assumed that female PhD students have already experienced different WLB relationships (balance, conflict, enrichment) of their multiplied life domains (studies, work, private and family life), and have faced dilemmas concerning them. It is further assumed that they have probably developed some coping strategies (Martinez et al. 2013) during their academic career to facilitate their WLB or ease WFCs. Main stakeholder intervention points can be identified by exploring the main areas of their utmost concerns; therefore, my two main research questions are:

1) What dilemmas do female PhD engineering students face when trying to create a WLB?

2) Which strategies do female PhD engineering students (want to) apply to achieve WLB?

The critical role of WLB is well documented in research (though often as a "side product" of attrition-focused research). But if we aim to make a change, it is also necessary to explore which factors influence the WLB of women PhD students and how. Namely, to understand how their dilemmas and coping strategies evolved. Accordingly, I also created three sub-questions. The first is:

- What main factors do female PhD engineering students identify that constrain and /or facilitate their WLB?

Both empirical and theoretical research concluded that women face additional obstacles in STEM fields, which may create a further constrain to their capabilities striving for WLB (Maxmen 2018, Xie et al. 2015, Beddoes – Pawley 2014). Women PhD students already face constraints due to the intersectionality (Crenshaw 1991) of their gender, marital, and parental status, age, and student status. In STEM fields, they have to also balance their way through less supportive male environments, regarding not just their motherhood but their female and

scientist identities. Being at the bottom of the academic hierarchy, they probably have fewer opportunities and tools to fight against prejudice and discrimination and also to fight for their WLB (Maranto – Griffin 2011). National context is also relevant; hence the already mentioned traditional family and gender norms in Hungary can strongly permeate their learning and working environment (Nagy 2014), supposedly making their WLB even more troublesome. In addition, I suppose that laboratory work and the use of hazardous substances also can hurt their WLB. These all lead to the second sub-question:

- How do studying and working in engineering influence the WLB of female PhD students?

Research studies highlighted that professional women face severe difficulties in integrating motherhood into academic careers; therefore, they tend to postpone childbearing (Mason et al. 2013). I suppose that the reasons for the postponed childbearing of higher educated women can be well grasped during PhD education, which is likely to overlap with the "ideal" age of becoming a mother. Highly institutionalised academic life courses may demand obtaining the degree before becoming a mother; meanwhile, women – in contrast to men – cannot postpone childbearing for an indefinite time. Moreover, their socially and culturally embedded biological clock (Mynarska 2010) clashes not just with the tenure clock but also with norms and special features of STEM fields: though women in STEM fields probably experience the chilly climate earlier than PhD education, they are more likely to face motherhood-related difficulties during doctoral studies. In addition, in Hungary, women become mothers at earlier ages, and the ideal age of motherhood is also set at earlier ages than in western countries (Paksi – Szalma 2009). This can generate a higher pressure in Hungarian top-educated women's lives and might also lead them to adopt new life patterns to follow. My third sub-question was developed accordingly:

- How do institutional and normative contexts shape the family plans of female PhD students in engineering, especially their timing of motherhood?

6. QUALITATIVE RESEARCH DESIGN

The goal of the present research was to explore the WLB of young female engineers during their PhD studies. 27 semi-structured interviews were conducted with female PhD students in the field of engineering during 2014 and 2015. The research was based on an exploratory qualitative research design, a method that is fruitful for the general understanding of a research problem (Creswell 2014). Since the more unfavourable situation of women compared to men regarding their WLB is well documented in academic literature, men, as a control group, were not part of the research design. The following four subchapters introduce the methodology applied in the present research: the semi-structured interview method; sampling, recruitment and sample description; validity and research ethics; finally, the analysis tools.

6.1 Semi-structured interviews

Data for the research were gathered by a semi-structured interview method, which was especially advantageous for the present exploratory qualitative study. Valid and reliable data relevant to this research issue were to be collected (Saunders et al. 2016), which were suited to template analysis (see later in this chapter, King 2012). Interviewing is time-consuming but has the unique advantage of being personal: the researcher is the primary instrument in data gathering and is able to collect information about the natural settings and the context of the interview (Creswell 2014). I could have immediate feedback on my questions and had the opportunity to clarify the data on the spot, which helped refine initial ideas, research questions and objectives (Saunders et al. 2016).

The interview guide was compiled according to the research objectives and included fully explorative and thematic questions as well. Questions were based on former research findings introduced previously, on my knowledge and experience as a female researcher about the issue, as well as on informal preliminary work, such as discussions with expert colleagues (King 1994). The interview guide followed the funnel technique (Vicsek 2007): it started with "ice-breaker" questions, then included complex, open-ended interview questions, supported by some closed questions if needed. It included the following main themes:

- Milestones of their academic and individual life courses, including career choice, timing, support.

- Meaning of WLB and their evaluation of their own WLB.

- Facilitating and constraining factors of WLB.

- Special features of studying and working in engineering that influence WLB.

- Differences between public and private sector jobs in terms of WLB.

- The ideal age and time for a woman to become a mother if she wants to pursue a PhD in engineering.

- Family plans, especially the timing and integration of childbearing into their career.

6.2 Sampling, recruitment and sample

The target group of this research consisted of women pursuing a PhD course in the field of engineering in Hungary. "To pursue a PhD course" was conceptualised as individuals who were enrolled in doctoral schools within the (original or delayed) official time limit of the programme and had not received their degree yet. This broad sense allowed the inclusion of students who were delaying semesters for different reasons or were part of the PhD candidate process. It was assumed that these cases would provide further WLB experiences for the research. In the following, the terms of *PhD students*, *students* or *women* will be used as synonyms, all referring to the group described above.

For data collection at a research site level, *purposive sampling was* applied (Saunders et al. 2016). At the time of data gathering, there were 10 branches of engineering operated in 33 doctoral schools in 14 universities (five in the capital, nine in the countryside) in Hungary (ODT 2016). One university was selected purposefully for the sample: it has a long history and a high reputation both in teaching and research excellence in engineering in the capital. Attending the same institution supposedly provided a more homogeneous social and organisational background of the students, which helped to gain an in-depth insight into the research issue (Saunders et al. 2016). This university offered doctorates in several different engineering disciplines, therefore it was assumed to be able to provide a pool of women engineers large enough for sampling, and also to offer information-rich cases: participants with different life course experiences, such as starting the PhD programme later than obtaining MSc degree, being a mother, working in a laboratory with hazardous substances or having a job in an academic or non-academic field.

For the further sampling at research site level, a heterogeneous (maximum variation) sampling strategy was applied within purposive sampling. Any patterns that emerge could be of particular interest, therefore identifying diverse characteristics as selection criteria before selecting the sample is a strength of the research (Saunders et al. 2016). As an earlier study (Xie et al. 2015) indicated that women often encounter more negative WLB-related experiences in male-

dominated fields. Accordingly, two doctoral schools were selected within engineering, based on their proportion of women, aiming at exploring different perspectives of the students in different institutional and social contexts (Creswell 2007). One of the chosen doctoral schools was in the field of chemical, environment and bioengineering (henceforth: CEBE), because the proportion of female doctoral students in this field was the highest (around 34%) and because it is characterised by intensive laboratory work. The other chosen doctoral school embraced electrical and informatics engineering (henceforth: EIE), where women's representation was the lowest, around 3% (KSH 2013).

Finding contacts with the students was challenging because their availability via institutions (websites, administration) proved to be poor. Therefore, contacts with the students were aimed to be established through the heads of the doctoral schools. In the case of CEBE, the recruitment letter was sent via email to all the students. During this *volunteer sampling* (Saunders et al. 2016) all volunteers were selected. In the case of EIE – due to the lack of answers from the management – contacts were made directly via email with those few students available on the websites and further cases were collected by *snowball sampling* strategy from volunteer students (Saunders et al. 2016). The sampling continued until it reached around the same number of participants as in CEBE, and this was also the saturation point of the sampling as well. It was the limitation of volunteer sampling that mothers were so under-represented in the sample that it did not provide enough data for grasping the effects of childbearing on work-life balance.[27] Participants were therefore asked to suggest mothers they knew to participate. None of the EIE students had female schoolmates with children to their best knowledge, but CEBE students did, therefore the sample was extended with additional young mothers from CEBE (from the same doctoral school). On the one hand, the self-selection of individuals might influence the results – because these students were eager to share their opinions and experiences, supposedly already having some WLB-related difficulties –, on the other hand, they provided highly information-rich cases (Creswell 2014).

Interviews The majority of the interviews were carried out at the doctoral schools or workplaces of the research participants. Only a few of them preferred to have the interview at home or at the workplace of the interviewer. Data on students were also collected a priori: curriculum vitae information from the websites and socio-demographic data on the spot. This information helped

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[27] Many of them probably failed to receive the recruitment letter because they were not included in or suspended from the email lists of the doctoral schools, and some of them confessed later that they were in an awful time-squeeze, and therefore ignored my letter at first.

me to identify academic and individual milestones of their life courses and to formulate more specific questions accordingly. The interviews lasted for 75 minutes on average and were tape-recorded for later transcription. Data collection, analysis and interpretation were anonymised. The interviewees provided oral informed consent to use the interviews for research and publication.

Sample description The sample consists of these two subsamples (CEBE and EIE), including 27 female engineer PhD students, attending two engineering doctoral schools at the same technical university in Budapest (see appendix). The CEBE subsample consists of 15 engineers: 10 chemical, 5 environment and bioengineers. EIE subsample consists of 12 engineers: 5 electrical engineers and 7 informatics engineers. The average age of the PhD students was 28.6 years in both subsamples, they were aged between 24 and 33 years. The youngest students (24-25) belonged to CEBE, while the oldest ones (32-33) to EIE. One third of both subsample were age of 30 or above. Regarding the personal background, these female PhD students had a strong family background in engineering. Almost half of their fathers was an engineer, but their mothers were only in a few cases. Among the rest of the parents, EIE students' parents, especially fathers, held higher degrees (MSc in other sciences). Almost a quarter of them also had brother(s) and sister(s) who were engineers. Nearly all students also had highly qualified partners, two-thirds of them an engineer. Every fifth CEBE student and every third EIE student was single, altogether seven single students out of 27. Half of the students who had a partner were married, including 4 mothers out of 5. All mothers were young mothers, having a child or children aged between 5 months and 6 years, and all of them belonged to the CEBE subsample. Two mothers were on maternity/parental leave, while one was on sick leave because her contract was terminated during maternity leave. With very few exceptions, these students were born in cities other than the capital. Most of them had moved to Budapest when they enrolled in tertiary education. A third of them (or their partner) – typically those born in the capital or close to it – had their own apartment, the others rented a flat or lived in youth hostels or with parents or grandparents. Very few of them practiced religion.

Regarding the institutional background of the interviewees, they had typically completed a highly prestigious high school in the capital or the countryside, and a third of them had attended 8-year extended high schools (instead of the more typical 4-year school). With very few exceptions, they were STEM oriented already in high school with a strong interest in biology and chemistry (CEBE students) or mathematics (EIE students). The majority of their teachers and family supported their motivation towards these fields, but not all. The average age at

enrolment was 25.1 and 26.5 for CEBE and EIE students, respectively. The majority of them started PhD school at the age of 23-25, and more than a third at the age of 26-32. They were in different phases of their PhD education at the time of the interviews, ranging from the first semester to almost obtaining the degree. Three of them did not work (CEBE students) and 24 of them held a job at the time of the interviews[28] (18 in the public sector, 6 in the private one). Two-thirds of them were involved in laboratory work; even some EIE students. For structured details and a guide to the abbreviations at the end of the interview quotations, see appendix.

6.3 Validity and ethics

The validity of the research was sought through different validation strategies in order to assess the accuracy of the findings. The *credibility* was established by introducing research methodology, trust-building with research participants, collecting rich and sufficient data, developing a thorough analysis by introducing different perspectives, quoting participants' own accounts. I reflected on my role in the research: I was aware that my background, identity and educational and work experiences shaped the whole research, including the choice of the topic, the selected method, the interview process and the interpretation of the data (Creswell 2007). The *dependability* of the research was established by recording all the changes during the emergent research design in order to produce a dependable account. Finally, the *transferability* of the research was engraved in the full description of each phase of the research, through which it can be judged to what extent present research findings can be applied in different settings (Saunders et al. 2016). My research interest had been primed before I became a mother, but my age and family plans certainly influenced the choice of topic. Though being a mother and a doctoral student led me to localise the research problem and to become fully engaged with the research; I did my best to bracket my personal experiences during the interviews and the analysis. I am also aware that it is "seldom perfectly achieved" in research (Moustakas 1994:80).

The research was also guided by different *ethical* considerations. The confidentiality of research participants was maintained by informing them about the nature of the research, the implications of their participation (volunteer anonym participation with oral informed consent forms), and sharing the same identity (being a female PhD student) also contributed to trust-building. Their privacy and identity were protected during the whole research: they could refuse to answer

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[28] Including those who were on maternity/sick leave during which their contracts had terminated.

sensitive questions, or, when they identified persons at institutions, then that information was anonymised. Their opinions were treated equally during analysis and interpretation of data (Bryman 2014).

6.4 Template analysis

Template analysis within thematic analyses (Braun – Clarke 2006) was selected for analysing the textual data of the interviews. This technique was flexible and was modifiable according to the needs of the research and allowed both inductive and deductive approaches (Saunders et al. 2016). I developed a theory and data-driven hierarchical coding template a priori and coded a few interviews; then it was further developed and modified according to the emerging new data (King 2012). All parts of the interview texts were coded and inserted into an MS Excel worksheet. The flexibility of this analysis technique might involve the danger of over-generalisation, a disadvantage that was taken into consideration during the interpretation of the data (King 2012). I interpreted the data according to the tradition of the constructivist paradigm, presupposing that students actively constructed and shaped their social reality through their understandings, meanings and practices, therefore, their subjective meanings were multiplied and negotiated through interactions with others and historical and cultural norms (Creswell 2007). Meanwhile, it was a limitation of the method that the reconstruction of the past is subjective and research participants can be inaccurate when giving answers about specific details of their life histories. However, the main point of the inquiry was to grasp how students perceive and interpret their work-life balance.

7. RESULTS: Work-life balance of PhD students

The introduction of research findings starts with a short general description of the WLB of women PhD students in this research. The chapter then follows the order of the research sub-questions: the second sub-chapter reflects on the first sub-question, while the third and fourth sub-chapters give answers to the second and third sub-questions, respectively. Finally, it closes with a short summary of the research findings.

7.1 Meaning and evaluation of work-life balance

By WLB, these young engineer women usually meant having enough *time* for activities in all of their life domains: education, work and private life. Notably, they did not mean to spend equal time on them – the time was interpreted in different frames. The majority of them assessed their WLB *daily*; it was an everyday task to schedule their time properly. Some of them described it even as a continuous, everyday fight against time, exhaustion and bosses: the words "hard" and "fight" appeared several times in the texts. Some others measured their balance *weekly*, for example they did not mind overwork during weekdays provided they could also run some family errands within working time. Finally, WLB was sometimes evaluated in the long run, where the importance of life spheres changed *monthly* or *yearly*. For example, when a short deadline project had gained importance over private life for a couple of months, or, in the case of childbearing, family life had become the priority in individuals' life for years. This latter time frame was obviously rooted in their assessment that having enough time for everything at daily or weekly levels was hardly achievable.

The ability to separate work and private life in terms of time and space also often appeared in the interviews, as another meaning of WLB. Meanwhile, separation was typically a strategy for the enhancement of WLB – this will be discussed later (chapter 7.2). In a few cases, WLB was rather seen as a lack of balance or difficulties, and in a few other cases positive connotations were found, such as work and private life mutually complement and help each other and are necessary for living a full life.

PhD students were asked at the beginning of the interview to evaluate their own WLB. Half of them considered their life quite balanced – they typically worked in the public sector, had a partner and were childless. A smaller group of women (a third) reported work-life imbalance, which was dominant among young mothers and those working in the private sector. The rest of them evaluated their WLB as mixed. PhD enrolment seemed to be quite reconcilable with

private life, but non-working women in our sample also reported a mixed and imbalanced life. They identified household chores as a main source of the imbalance, which was a new activity after leaving the parental home. PhD studies also conflicted with partnership; some women voiced that they would have had a better balance if they had been single. Pursuing the degree included heavy teaching activity, and a significant majority of the PhD students also worked in parallel with their studies. They were having work and family life domain in addition to their private life and studies definitely negatively affected their WLB. Chemical/bioengineers were less satisfied with their WLB than electronics/informatics engineers, but it should be considered that all mothers who were chemical/ bioengineers reported worse balance than their childless counterparts. Hence, it is telling that I could not find any electronics/informatics engineers who had children during the sampling process.

As the interviews progressed further, a more detailed and altered picture on PhD students' WLB emerged. Many of them became aware during the interviews that they had faced severe WLB-related difficulties and even re-evaluated their balance by the end of the conversation. But many of them persisted in their favourable assessment even after reporting everyday conflicts and stress in their lives. In the following sub-chapters, these difficulties and conflicts are described in detail.

7.2 Constraining and facilitating factors

The most widely mentioned factors that facilitated or hindered the WLB of these PhD students the most also circulated around the issue of time, not surprisingly similarly to the way they interpreted WLB. Firstly, the heavy w*orkload* resulted in long working hours that stretched the time-frame of their days, weeks, or months. Secondly, *flexibility* played an ambiguous but key role in their time management to strive for a better WLB, thirdly, *labour market and workplace uncertainty* mainly derived from employment based on short-term contracts, but also from the discrimination of women. In this chapter, these three factors are introduced.

7.2.1   Workload

Hindering factors of WLB were more frequently mentioned by PhD students than facilitating ones. One of the main constraining factors that influenced their WLB was the heavy workload they faced both during their studies and employment. Three of the PhD students did not work (all were chemical or bioengineers) in parallel with their PhD studies, while twenty-four of them

held a job at the time of the interviews[29] Eighteen PhD students worked in the public sector, six in the public one. They, however, struggled with not "just" work-life balance but with education+work-life balance and had to meet the multiple and multifaceted requirements of early-stage professional careers – such as course work, examinations, PhD and workplace research, teaching, laboratory work, conferences, international mobility, publications, administration tasks, etc., which definitely constrained their WLB in different ways. In the following, the sources and consequences of a heavy workload will be described, and some strategies of these women for easing their burden.

7.2.1.1 Sources and consequences

One of the primary sources of heavy workload in the *academic sphere* was the massive amount of teaching-related activity both for chemical and bioengineers and electrical and informatics engineers. Tutorial work was particularly demanding because they had to undertake the supervision of more undergraduate students than they could tackle. Moreover, they tended to accommodate their timetable to undergraduate students, who generally contacted them after regular working hours. Women in my sample considered their students' progress highly important and helped them in every possible way. Therefore, they made themselves almost always available and reciprocated the support which they also had received during their undergraduate period. Meanwhile, they were also interested in providing maximum support for them because undergraduate students often assisted in their PhD research. The other primary source of the heavy workload was project-based work undertaken by the departments in the form of contracts with research partners in the business sector. Project work played a significant role in the departments' life; it strengthened the inter-sectoral collaborations, fostered professional careers, and supported the department's operation. PhD students were typically assigned to project work, which was often their additional source of income, however, short and strict deadlines required work well beyond the 40-hour workweek.

PhD students working in the *private sector* in parallel with their studies also experienced a tremendous amount of work. Though they had less demanding teaching tasks – they were obliged to teach "only" within the framework of their PhD education – their work was typically based on short-term projects in line with short deadlines. These conditions often implied an extreme working mode for them, such as carrying out projects within half the time allocated.

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[29] Included are those who were on maternity/sick leave during which their contracts had terminated.

Several PhD students highlighted that workload in the business sector differed according to the profile and the size of the company. Handling workload at universities and private research institutions seemed quite manageable for them. However, workload for chemical engineers at pharmaceutical companies and for electrical and informatics engineers at start-up companies were found especially demanding.

Heavy workload typically resulted in *overwork* in PhD students' life. The majority of them, regardless of the sector of employment, reported long and unlimited – typically 12-14 hour – working days and months of work without days off at the weekends. The phenomenon was more typical among EIE engineers, but all the mothers and pregnant women of CEBE students (except one who was prohibited from taking work home) belonged to the excess workers. Students also frequently worked during Christmas and Easter holidays or mothers in the last month or days of their pregnancy. A 32 years old married electrical engineer – who had a supporting engineer spouse – explained how they were unconsciously pressured by organisational norms to be always present and available. They could not take days off with light hearts; they were "punished" even for their one-week honeymoon: they were made responsible for the chaos they faced after returning since substitutes for their work were deliberately not assigned.

Students had tried different time schedules to meet the demands of long working hours. Based on their accounts, I distinguished two working models, but neither of them was sustainable for them in the long run. The first working model these women followed included an all-day shift until late at night at the department without any considerable break. Basically, this model was the dominant "male" working model both in universities and at private companies, and they were typically childless, single or dual (engineer) couples among the women who could follow it. *Long hours* in the departments frequently caused time-based work-life or work-family conflicts, *regardless of the sector* of employment. This pregnant chemical engineer used to work in the private sector but switched back to the public one, where she could better balance her studies, work and family life.

> *There was so much stress in the private sector that it was simply not possible to have a private life. Or well, if a woman is thinking longer-term, then it is also important to have time for private life. [...] Well, overtime, clearly, there's a lot of overtime, tighter deadlines. (4/CEBE/28/c/preg/w)* [30]

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[30] For abbreviations see appendix

For example, for single PhD students, *finding a stable partner* was an extra challenge, partly because they tend to spend their "whole life" at the university. In many other cases, women completely and permanently pushed back their private life due to continuous overwork, which was not sustainable if they aimed to have a family at some time.

Female PhD students in this research – due to the lack of female role models and the pressure stemming from the departments – had usually *tried this "male working model" first* at the beginning of their studies and/or work, and only after they had become exhausted or had faced too much conflict had they switched to the second model. In the second model, women – usually with children and/or a partner – inserted some private or family time between the daily work and the evening/night shifts at home. Young mothers also of a two-year-old child worked regularly for 13 hours a day. Her words well describe the model

> *Indefinitely, [...] I have done a lot of project work at home at nighttime. [...] Well then maybe it was my husband who suffered more because [...] it was then that I put the child to bed and said, "don't talk to me" (12/CEBE/30/m/1chi/w)*

Since she was also responsible for taking and picking up the child at nursery school, she had no other choice but to continue her work at home at night, but this overwork caused conflicts with her husband. Her words well describe the phenomenon of how women in this sample were responsible for the second shift beyond their studies and work. This second model was considered rather the "female or family working model" and it was less acknowledged – as will be discussed soon.

As we see, long working hours often resulted in different WFCs in these women's lives, regardless of which model they followed. As a consequence, female PhD students in this sample soon had become *overburdened and in few cases even burnt out*. A large group of them had reached their physical limits, which was typical in both sectors of employment but more severe among PhD students who worked in the private sector. Women frequently reported stress, and expressions such as "squeezed until the pips squeak (kipréselik)" and "sucked dry (kiszipolyozzák)" also appeared a couple of times when they described their WLB.

> *Extra hours are expected and ever more scientific results, and there are people who internalise the stress and some people are nervous ... You can tell: they have nervous ticks, and they are tense or in a sour mood. (11/CEBE/29/m/0chi/w)*

The pressure was coupled with the high expectation from the management demanding not just long hours but also high productivity from these professionals. This pressure resulted in stress

and nervousness – as this chemical engineer described above. With few exceptions, almost all women concluded that life seemed to be more tranquil, more reconcilable in the public sphere – but only compared to the private one.

Overburden, stress and bad mood experienced in doctoral schools or at workplaces generated negative work-to-family spillovers in several cases: *tiredness, exhaustion* and in one case of a mother, insomnia became persistent in their life. These effects, in turn, recoiled upon their work and research performance. This chemical engineer mother found students' attitudes hardly bearable. Though she tried to avoid negative spillovers, but stress and tiredness filtered into her workplace job. She was also unable to sleep well, which affected her well-being as well.

> *Unbelievable what can come up[…] I go home in such a manner, obviously I try not to take this out on my family, but this causes insomnia, I am just turning in my bed, can't sleep, and from here my performance at my workplace the next day is like… (3/CEBE/31/c/1chi/w)*

These strained-based work-to-family conflicts caused health problems in several cases. Few students were definitely aware of the harmful effects of their overwork; a woman, for example, reported a recurring illness she produced at every tenth week of the semesters. Childless engineer couples seemed to be more exhausted; it seemed that they particularly tend to spend very long hours with work. An electrical engineer woman shared that they both were aware of their unhealthy working mode. It was warning that only after becoming really freaked out, ill or having quarrels with each other had they realised how harmful their way of life was.

To return to the two working models introduced above, women in this research could not follow either of them in the long run because they could not reconcile them with their private and family life. Meanwhile, according to these women, long hours seemed to be quite manageable for their male counterparts. This marks different academic life courses for women and men, typically increase gender inequality. *Firstly*, long hours were mentioned by PhD students several times in collocation with a successful researcher career. Namely, success can be achieved only by long working hours. The more hours one devotes to work, the more successful they will be.

> *You can put into it as much or as little as you like. So there are plenty of people who work a lot less and make much less out of it, so their successes are also smaller. This way you can somehow get a balance (16/EIE/26/c/0chi/w).*

The problem is – as it also highlighted in the quotation above – that WLB can be achieved only by regular or reduced working hours, and it is the individual's decision which way s/he chooses. A large group of female PhD students – particularly those with family and/or dependants – faced therefore, a Catch-22 situation because they could not invest as many hours into their professional work since they were also mostly responsible for caring and household tasks beyond their studies and work.

Secondly, the capability of male peers or colleagues for extremely long working hours was strongly associated not just with a successful career but with the image of the "ideal, good researcher". Women in this sample sometimes concluded that they failed as professionals because they could not follow the male working model due to their weaker stamina compared to their male counterparts sleeping only a few (4-5) hours a night.

> *And then there are those research colleagues who live and die for science and who are able to get up at 4:00 a.m. and be at work until 10:00 p.m. [...] Well, some people have wives and kids, I don't know how much they see of their families. (11/CEBE/29/m/0chi/w)*

The mother of three children in the present sample also equated her husband's extreme working mode with the image of a "highly motivated good researcher". It clearly shows how gendered the life courses are; though her husband also was an engineer and also had the same three children, she was primarily responsible for childcare. Meantime, her researcher husband could invest a huge amount of work into his career. Another few students also shared that those colleagues who followed the second "female or family working model" were typically considered by the others (who did not have a family) as members of the "lazy group". This brings us back to the image of the "good employee", who is always at the disposal of the company, and to women who are considered less devoted, secondary employees (Coser 1974).

Finally, the huge workload also caused *conflicts between PhD education and work*. Almost none of these female PhD students could progress with their PhD because it was always subordinated to institutional interests, which changed with need and time. The words of the following married chemical engineer describe the general phenomenon these female PhD students experienced-

> *Ah, I deal with everything except my work. At our department, every PhD student and actually every colleague has tasks that support operation and tuition [...] at the expense of writing the dissertation. (9/CEBE/28/m/0chi/w)*

A few other PhD students even recalled they did not have any idea what the PhD programme would be like in terms of workload and time management, and only after one year of enrolment did they realise that they could spend only a couple of hours weekly on their dissertation. One of them added with a touch of slight sarcasm in her voice that if there was no project work at the weekend, they were free to decide how they spent it. The time for PhD research was further limited when the dissertation topic and the workplace research differed or when students had to perform twice according to the different requirements of their boss and their tutor. As a consequence, women students in this sample typically lagged behind with their PhD-related tasks, which definitely delayed their obtaining the degree. This phenomenon has vital importance regarding the timing of childbearing, which is discussed later in chapter 7.4.

7.2.1.2 Strategies

Female PhD students did not have well-developed *coping strategies* to ease the conflicts between studies, work and family life introduced above. As a main strategy, a few of them had already switched from the private sector to the public sector, aiming at a better balance. Nevertheless, they developed and tested different practices, changed them when they proved to be insufficient, as we saw in the case of the two working models. Saying no to overwork was one of their strategies, but only less than one third of the interviewees managed to finish their studies or work within the official working hours. The majority of them did not work in parallel with PhD education or worked in the public sector. The reason that very few students in the business sector *did not overwork* was that they were prohibited from taking work outside of the institution, or they held a part-time job. In many other cases, women protested against overwork because they did not want to follow their higher educated parents' pattern. A couple of women confessed that their parents did not have enough time for them, as children. Other PhD students simply saw how negatively overwork – particularly travelling – affected their colleagues' family life and determined not to follow their pattern.

Separation of life domains also often appeared as a strategy for these women for boundary management. This aim was so strong that if they succeeded, some of them considered their life balanced, as I introduced it at the very beginning of chapter 6.1. By segmentation, women usually meant temporal, spatial and emotional segmentation, typically in the work-to-family direction. The majority of them tried to control the boundaries by avoiding communication with and/or about the other domain: typically, by not receiving work-related phone calls or responding to emails at home. Meanwhile, the majority of the students failed to keep these fields independent from each other, and they rather experienced their interdependence (conflict), as I

described above. Almost everybody checked their emails at home – and realising this, an engineer couple deliberately spent many weekends in the countryside with their families when they got overwhelmed by work in order to "shut off" work completely.

The other typical strategy was to *communicate the boundaries* between work and private life to the gatekeepers: tutors, bosses and partners. Communication meant a continuous "fight" on a weekly or monthly basis, along with conflicts and stress. Those PhD students who reported better WLB achieved it through years of practice. This longer quotation is an essence of the phenomenon of long working cultures and the necessity of conscious communication. A quite young informatics engineer had to negotiate every week for years not to be burdened with weekend work. Meanwhile, her words also show how WLB was usually perceived as solely an individual responsibility.

> *I have a personal life balance, but I had to fight for it and it's a constant source of conflict and stress. [...] Every Friday, the man's consultant asks if you can progress with the research at the weekend. [...]I was angry that I didn't have a life, but in return, I blamed everyone else. (18/EIE/26/c/0chi/w)*

The role of *adequate scheduling* appeared in several cases as a strategy that enhances WLB. Schedule control was also seen as individual responsibility and also required conscious communication with the gatekeepers. Only one student summarised that frequent overwork was a sign of system malfunction. Women in this research developed various strategies to control their schedule – with greater or lesser success. In many cases, they found it important to synchronise their schedule with their partner in order to have private time together in the evenings, and, also to be able to spend some time with the children before going to bed. A woman reported that doing sport and having a large family taught her to schedule wisely and to work fast. Last but not least, a large group of PhD students made their schedule lighter by choosing apartments near the university or workplace in order to decrease travelling time between work and home. This was frequent in the case of intensive laboratory work – an effect that is described in chapter 6.3.1.

Support from the *partner* also worked as a coping strategy to mitigate work-to-family conflict and stress in these female PhD students' lives. Interestingly, this strategy seemed to be even more pronounced than is reported in the literature (Byers et al. 2014, Martinez et al. 2013). A recently engaged woman shared with us light-heartedly a widely known and acknowledged aphorism in engineering regarding the marriage market for her and her peers. *Well, I have a wise saying for that, which unfortunately isn't mine, but I learnt it from someone else that girls*

have to obtain two things at university: a degree and a husband. (8/CEBE/25/c/0chi/0w). The "wisdom" that women ought to find a partner at university before obtaining their degree also predicted the difficulties women would face in this knowledge-intensive job. Moreover, high educational homogamy – or even having an engineer partner – definitely enhanced their WLB. It seemed that those *who had a partner* at the time of the interview did indeed find mates from engineering or from other research fields. They also shared a strong opinion that only those people can understand and therefore support them, who understand the nature of their professional work. To highlight its importance: the lack of understanding caused conflicts with the partner in a couple of cases. *I had a sweetheart from high school but he was inreconciable with my life at the university. We had conflicts and it was a trauma to break up with him (18/I/26/c/0chi/w-pu)* A few younger engineers shared that their partner did not tolerate the flexible, long-hour feature of academic work, which played a significant role in breaking up their long partnership.

Finally, a few students mentioned how *international mobility* was a final solution for some of their peers. When none of their strategies worked and they could not bear the work-family conflicts any longer, they found a PhD scholarship abroad. International mobility in these cases also served as an escape from the turmoil in universities. Female PhD students could make better progress with their PhD abroad, where they were not assigned to other professional or even secretarial tasks as it is usual in Hungary. NB! One student mentioned that the head of the department had even sent administrative tasks via email to a female PhD student who was spending several years abroad on a PhD scholarship. This also shows how administrative tasks are typically assigned to females at academia, even if the work has to be sent abroad.

> *Simply what happens here at home [in Hungary] at universities makes it completely impossible for people to do research under normal conditions. [...] There's still a better chance (abroad) of being a professional and not a secretary masquerading as a research assistant. It is cheaper to have a doctoral student than to employ a secretary (in Hungary) (14/CEBE/29/m/preg/w)*

While women are slightly more mobile during PhD education in Europe, in Hungary this is less typical (She Figures 2018), which curbs women's opportunities for international mobility. It is worth considering that while universities should be interested in decreasing the high attrition rates, especially for women, universities themselves generate working conditions that make PhD studies unworkable.

7.2.2 Flexibility

Flexible working arrangements – both PhD- and job-related – played important roles in students' WLB in the present research. The majority of these women already had labour market experiences, usually in both sectors in forms of work, fellowship, or practical courses. When students were asked about the sectorial differences in terms of WLB, the issue of flexibility was the first facilitating factor to be mentioned. All of them characterised working arrangements in the public sector with high flexibility and those in the private one with rigidity. Meanwhile, (in)flexibility proved to be a complex phenomenon, and students pondered its advantages and disadvantages very thoroughly during the interviews. In this subchapter, the effects of flexibility and inflexibility on WLB, as well as their pros and cons, will be introduced.

The most frequently mentioned type of flexible working arrangement in the academic sphere was *flexitime* – mainly perceived by PhD students as a facilitating factor of their WLB. These women were able to control their schedule and to adapt working hours to private and family needs within certain limits. They were almost free to decide how to schedule their days or weeks, except for some fixed events, such as teaching, meetings or laboratory work. The sense of capability for flexibility decreased their time-squeeze, therefore their stress level and WFC. Flexitime was especially a key issue in work-*family* balance for young mothers in this sample (NB! They were chemical or environment engineers, learning and working in quite gender-balanced environments). Firstly, students had the opportunity (by law) for part-time work in parallel with maternity leave (until their child reached the age of three), which helped their reintegration into work. In this flexible academic environment, students could schedule even part-time work with more flexibility than their counterparts in the private sector: step by step, working mainly from home at the beginning. Meanwhile, young mothers noted that reduced work hours even after their child was three years old would have helped their reconciliation of work and family life, but part-time jobs were and are scarce in Hungary. Secondly, flexitime allowed them to follow the second working model; to meet daily family demands, such as school pick-up times, taking care of a sick child whilst working from home. This flexibility was often contrasted with private sector employment in the dialogues.

> *The university is a very family-friendly environment, amazingly so, of course there are obligations but you can go for your child, if they are sick, it can be solved; we can talk about it. I have no idea how to do this in a pharmaceutical company. I don't know. Where do you put them when they're sick? I think that's a challenge. (14/CEBE/29/m/preg/w)*

To continue this thought, flexitime was not typical in the private sector, let alone those of analytical companies with rigid laboratory work schedules and strict deadlines. Students only in a few cases were free to decide on when to start their 8.5-hour working day and had the opportunity to finish work earlier in the case of urgent family tasks – but the work had to be performed later. In a few cases, women evaluated their working conditions in the private sector quite positively at the beginning of the interviews, but later, during the deeper inquiry of the interviews, they listed several intervention points for improvements – such as more days off, flexible working hours – and even modified their earlier favourable assessments.

> *Well, when you first asked me how or what was their attitude to the family at work, my first answer was actually totally positive, and when I started to say that there was room for improvement, maybe that's the point where there's a lot left to talk about. (15/CEBE/31/m/2chi/w)*

Flexitime in the academic sphere generally implied the opportunity of flexiplace for students: they were also able – to some extent – to control where they worked, which also positively affected their WLB. In this sample, women working in the public sphere were at liberty to work at home a) when their child was sick, b) as a part of the step-by-step reintegration into work after childbirth, c) in the case of overwork. These are rather ad-hoc practices and not flexible working arrangements and are definitely not equal to regular home office or telework[31], for which we found only a few minor examples. Moreover, the opportunity for working at home highly depended on the type of the work, since laboratory work, complicated computer analyses, teaching activity or meetings required personal attendance at the workplace. In the private case, flexiplace was even less of a phenomenon than flexitime, moreover, in a few cases employees were prohibited from taking work outside of the companies by regulations. It was much less supported than in the academic sphere, therefore it was another intervention point students identified when they were asked about how their WLB could have been facilitated.

In spite of the advantageous nature of flexibility, it also appeared as a double-edged sword, especially in universities, as has been internationally revealed (Hobson 2011, Peters et al. 2009). On the one hand, students enjoyed the high flexibility and a higher sense of capability of balancing work and private life, on the other hand, they often suffered from its disadvantages. Flexible borders between work and family life can easily result in the expansion of one life

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[31] Working regular hours daily or regular days a week at home instead of at the workplace, based on either informal or formal agreements between students and employers (ref needed).

domain described by Clark in the border theory (2000). In the present case, PhD students in the public sector regularly expanded their education and work domain in order to be able to manage the huge workload, but it severely impaired their private life. The motto "tasks should be done, no matter how and when you do them" was repeatedly mentioned by PhD students during the interviews. *This is a flexible workplace: working hours can be flexibly expanded. (9/CEBE/28/m/0chi/w)* This attitude stemmed obviously from the management: the expansion of working time and place were not necessarily based on these PhD students' preferences. Their choices were often based rather on external demands and social norms of academic environment. This employer-driven flexibility (Smith et al. 2008) also contributed to the uncertain environment in academia for some women. Some PhD students found rigid working conditions in the private sphere even less disadvantageous than flexibility at universities, for its predictability in terms of time commitment – as was also found by Blair-Loy (2009). In sum, almost all PhD students who discussed the advantages of flexibility at academia also mentioned its disadvantages, similarly to this young, childless informatics engineer:

> *There is no regularity in it, because we never have important tasks, but we only always have urgent tasks. There's a terrible uncertainty as we don't have fixed hours. (18/EIE/26/c/0chi/w).*

It was an extreme, employer-driven expansion of the border when meetings at the university started at non-family-friendly times, such as 6 pm. Childless students usually adapted to these agendas on account of their WLB, but young mothers could not reconcile them with family life. This also placed them into the less valued, second working model group described above.

Nevertheless, in the case of professional work, the expansion of the border was partly employee-driven and was based on PhD students' preferences, devotion to and motivation for work. In our case, these women were eager to meet the requirements of their work and also aimed at finishing their PhD as soon as possible. This high degree of flexibility required very thorough scheduling of work and family life. Especially younger students struggled with time management at the time of the interviews, but older women also reported how they were forced to learn it in the first couple of years in PhD education in order to achieve a better WLB.

> *It's a big difficulty that there's no military-like order as in the private sector, it's a bit of a difficulty for me, but you have to learn to allocate your time on your own. (4/CEBE/28/c/preg/w) On the one hand, of course it is positive because it can be done at home and gives flexibility, on the other hand it is negative because there is no limit. (20/EIE/33/c/0chi/w)*

Flexiplace also appeared as a double-edged sword. The majority of these women, if they could, tended to avoid working at home, as it was described in the previous chapter; meanwhile, the majority of them took work home. Working at home – both when the child was sick or in the evenings after their full-time job and often their second shift – extremely expanded their working hours and also melted and blurred the boundaries between the spheres, mostly because of receiving work-related contacts and communications (Glavin – Schieman 2012) and multitasking (Demerouti et al. 2014). Finally, a few PhD students also highlighted that they had to be cautious regarding flexiplace, because though they were quite free to decide where they worked, personal attendance (face time) was still expected by the management.

7.2.3 Labour market and workplace uncertainty

The vast majority of female engineer PhD students in the present research worked in parallel with their PhD studies and perceived very similar uncertainties stemming from the labour market as their postdoc or senior counterparts in western countries (Bernardi et al. 2008, Blossfeld et al. 2005). They all identified three main sources of uncertainties – precarious employment forms, low income and gender discrimination –, which heavily affected their WLB in different negative ways.

Short-term contracts implied a vital problem particularly for mothers and women who wanted to become mothers some day. Half of the working students were employed on *fixed-term contracts*, out of which two-thirds were very short-termed, 2-12 months. Precarious employment forms were present both in the public and private sectors, but women in this sample working in the private sector all held a position with a fix-term contract. Such extremely short contracts implied continuous and severe stress in these women's lives. They often considered quitting their jobs and leaving science, but they always stayed and waited for a more stable status in the hope of remaining on the academic track. This 24 years old, freshly enrolled PhD student painfully complained about the untenable situation:

> *I thought long and hard (about whether to quit) as we were messing about with two-month contracts and that was a constant stress. So after a month, I was already stressing that would it now be renewed or not. [...] they didn't do that to men. (24/EIE/25/m/0chi/w)*

Early-stage researchers – therefore men also – are likely to be employed with fixed-term contracts at an increasing rate (She Figures 2018), but interviewees – as the quotation above refers to it – also hinted that their male counterparts usually hold more stable positions. This

labour market inequality between the genders was more tangible in the case of engineer couples. Few women shared that her male partner – with the same qualifications and the same number of finished semesters in PhD education – received a permanent contract from the university right at the beginning of his employment.

The *low income* these PhD students received was the other source of their labour market uncertainty. Neither PhD scholarships nor assistant researchers' salaries were sufficient to leave the parental home (rent or buy an apartment) and establish a family. Though this phenomenon is general in Hungary, it is still worth pondering that even higher educated youths in high-tech professions face this high uncertainty. Moreover, the gender pay gap in engineering in the private sector among youths could be even as high as 60 percent (She Figures 2018). Neither did the labour market support motherhood during higher education studies; until 2014, these students were not eligible for maternity leave if they become mothers during PhD education. At least half a year of active employment was needed to become eligible (at the time of the interviews), but at the same time, PhD students could not work full-time if they received a scholarship. These circumstances curbed women's capabilities for WLB.

Uncertain forms of employment and low income in academia made life courses not just highly insecure but gendered. Based on the reports of these women, life courses of women and men engineers started to diverge significantly as early as PhD education. The male breadwinner model and women's primary caregiver role often manifested in the discourses of the interviewees. Women described that male engineers – their partners and other colleagues – tended to seek positions in the private sector that provided higher incomes to establish a family. In contrast, women were likely to stay at the university or seek employment in other public research institutes that offered better opportunities for harmonising work and family life. A pregnant chemical engineer working at a public research institute well grasped how career paths are differed in engineering:

> There is the classic way when the woman is more involved in household chores and childcare while the man works. Meanwhile, in return, the woman can choose her career more freely, for example she can afford to pursue the PhD or can become a mother during PhD education (4/CEBE/28/c/preg/w)

Apart from women's contractual segregation and lower income (She Figures 2018), these female PhD students experienced other forms of *discrimination* based on their gender, planned or actual motherhood. While thre are six prohibited grounds of discrimination in the EU[32], in Hungary, there are twenty protected characteristics by law, including motherhood (pregnancy), fixed-term contract and part-time work. Despite the law, these young researchers – both mothers and childless women – frequently voiced their fear concerning their reintegration into the labour market after childbearing. For example, short-term contracts of three mothers in this sample terminated before or during maternity leave. In one case, this general uncertainty had become open discrimination: a mother of three children (worked as a chemical engineer at the university) shared that after juggling few-months or half-a-year mosaics of employment for years, she just would have received a more extended contract, but the management was informed about her pregnancy, therefore the date had been changed only till the supposed day of delivery of her child:

> *My biggest fear of getting back was what was going to happen. To begin with they try to escape if they hear a child. (13/CEBE/33/m/3chi/w)*

Her words echoed the majority of the students' similar fears, and the high-level insecurity in their life. Few of them even projected age-based discrimination by their employer because mothers would be in their late thirties of even early forties after having one, two, let alone three children. They had already encountered examples in their work how employers selected younger, childless professionals for the different positions. Another example is that though it is forbidden by law to inquire into parental status or family plans during the job interviewing process, several women engineers in this sample shared that employers always found their way to this information or they simply asked directly during the interview process how many children they were planning and for how many years they would want to break their career.

> *My future career is uncertain in connection with this, because I don't know how I could leave, how I could return, how I could carry on, and who will say what to that. […] things like that make me feel insecure. (8/CEBE/25/c/0chi/0w)*

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[32] Grounds of discriminations in the European Union: equality directives (2000/78/EC, 2000/43/EC, 2002/73/EC). Age, disability, sexual orientation, religion or belief, racial or ethnic origin, gender.

Finally, it also appeared during the interviews that even those young mothers who have a position could face discrimination due to childbearing. Employers do not tolerate either too many or long career breaks or too many days off to take care of sick children. Even this married and childless electronic engineer women had a heavy experience despite her young age:

> *My experience is that when you go out to give birth, stay at home for two years and go back, they pull funny faces or you get fired. But if you leave to have a second child from the same job, it is sure that you are going to get fired in the end. (24/EIE/25/m/0chi/w)*

Some students also mentioned how young mothers were perceived as secondary citizens, especially in the private sector, because they were expected to be less productive due to their caregiver role and responsibilities. Interviewees also emphasised that women are even less capable to fight against their discrimination in their male-dominated profession, because stakeholders in this profession are usually men. Therefore, they often concluded that women are more likely to be discriminated based on their gender and motherhood in engineering than their female counterparts in more gender-balanced fields.

7.3 Studying and working in engineering

This sub-chapter elaborates findings related to my second sub-question: *"How do studying and working in engineering influence the WLB of female PhD students?"* Based on the texts, two main dimensions of hindering factors were revealed: the inflexibility and health hazards of laboratory work *and* different negative, gender-based experiences of students in their male-dominated environment, namely, the chilly climate.

7.3.1 Laboratory work

Irrespective of the examined engineering disciplines, most of the PhD students mentioned laboratory work as a special feature of engineering that limits women's opportunities for balancing work and family life. In this research, the majority of the students' work involved laboratory work, especially that of chemical engineers. None of the students considered the issue of WLB when choosing this career, let alone the possible disadvantages of laboratory work. Very few recalled that their attention was called at the beginning of their PhD education to how working in engineering would not support WLB in certain cases, and some of them saw that time their older female peers already struggling with WLB. Laboratory work affected students' WLB in two major negative ways. Firstly, laboratory work was often *inflexible* in

terms of time, place and safety regulations. Secondly, it implied *health hazards,* especially in relation to childbearing. Therefore, laboratory work was prohibited during pregnancy. In the following, we will introduce these two ways and how students stretched the boundaries of their different life domains in order to achieve a better balance.

7.3.1.1 Inflexibility

Inflexibility affected the WLB of both chemical and bioengineers *and* electrical and informatics engineers. Though they tried to plan their lab days thoroughly, they often met long working hours due to the *inflexibility* of laboratory work: many of them reported 10-16-hour long lab sessions. Day-long running measurements literally could not be stopped otherwise both work and expensive materials were wasted. Inflexibility, therefore, definitely curbed students' private and family lives after lab work in terms of time. Moreover, the necessary time for completing measurements was also often unpredictable, therefore they could not always plan their evenings on lab days, as this chemical engineer explained:

> *If something doesn't work then you have to start again, so I think it definitely limits the opportunities after work. (6/CEBE/26/c/0chi/0w)*

Measurements usually required longer periods of time – days, weeks –, and these PhD students were usually powerless to control laboratory work. The heavy workload and the inflexibility of lab work often led to weekend work in their lives. A host of reasons for weekend work was identified during the interviews, it included limited laboratory capacity on weekdays; privacy for the research due to sensitive data; or safety regulations that prescribed more than one person to be present when working with hazardous substances. The next example well summarises the obstacles and also reveals how this dual career couple working at the university sacrificed their weekends for years and how partner support was needed for the woman to progress with her research and obtaining her PhD.

> *In those three-and-a-half years, I think I worked three weekends out of the month on my own work, that is, my research. Because then the lab was free, no one bothered me, no one could look down on what I was doing. […]. I had to give up a lot of things, or that is how I feel, to make that happen. […] But there are rules that you cannot be alone in the presence of strong chemical acids, and if it wasn't for my husband standing there next to me or doing something for himself, I wouldn't have been able to persuade anybody to come in and work with me on Saturday. […] (the PhD) would not have been five years, but fifteen years (24/EIE/25/m/0chi/w)*

Laboratory work was unequivocally inflexible spatially. therefore the location of the students' apartment played an important role in their WLB. In our case, several students took advantage of the (purposefully chosen) closeness of their apartments just to be able to "pop in and out" of the university and/or workplace at the weekends to run, check, start or finish measurements. However, going into the lab beyond working time forced students to cross the borders frequently between work and family life. In our case, here again, when the partner was also an engineer, this caused fewer problems between the partners.

7.3.1.2 Health hazards

Apart from inflexibility, the majority of the students mentioned *health hazards*, as a special feature of engineering, which definitely negatively influenced WLB. In the field of CEBE, the majority of these women worked with – not radioisotopes, but other – quite hazardous substances, but examples were found of using quite unhealthy materials among electrical engineers as well. The danger of health hazards was most frequently mentioned in relation to childbearing and WLB, and students also noted that these substances can harm not just the babies but they are also harmful for humans in general: both women and men can be exposed to the cumulative effects of these chemicals.

According to the regulations[33], laboratory work is prohibited during pregnancy and women have to inform the head of laboratory or department about it and quit lab work as soon as possible. Even those women whose PhD or workplace research did not include lab work, had to reschedule their tasks during the risk period, since PhD students were assigned to teach lab-related courses and supervise BSc and MSc students. It was also an obstacle that school regulations allowed only two consecutive inactive semesters. This significantly curbed these women's capabilities for WLB, since – as a few others mentioned – conception and breastfeeding all belong to the risk period, which further lengthened women's career breaks.

Nevertheless, it gives food for thought, that researchers cannot be cautious enough, even if they adhere to every safety protocol and regulation rigorously. Firstly, they work with hazardous substances, which could unavoidably and easily spread in the air. Secondly, "normal accidents" (Perrow, 1984) can always happen, as happened in the case of this pregnant PhD student in the lab. Though she was the only one in the sample to report such an accident, it is vital to highlight

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[33] Only one student (14/B/29/m/preg/w) read safety regulations in a "notebook" she was given, which prescribed which substances' usage was prohibited during pregnancy, but nobody checked whether they followed the rule or not. They always referred to them: *"I suppose it had to be somewhere"*; or *"I have not seen any yet, but this is the custom"*, *"In theory, there should be one"*.

how this woman did not perceive the invisible risk and ignored the side-effects and their consequences in the long run.

> *I learned about my pregnancy rather late (11th week), and I accidentally knocked over some carcinogenic solvent in the lab before I even knew. Well, the baby was affected a bit, but it was only for one or two days. I was close to the X-ray equipment as well, but without it causing any problem (4/CEBE/28/c/preg/w)*

The majority of the students emphasised that if a woman wants to have her child during PhD, she will probably have to schedule it after finishing her lab-related PhD research. However, this was not easy. As a matter of fact, the health hazards of laboratory work can affect women's timing at any time during their careers. Based on the interviewees' experience, the risk was different according to age: the younger ones were exposed to childbearing-related risks, the older colleagues were more subject to gynaecological problems. That is why many students concluded that women should not postpone becoming mothers because the longer they postpone it, the more difficult it may be for them to conceive. They based their opinions on their experience with older colleagues, who had difficulties achieving conception or had gynaecological problems in their midlife.

> *It is worth (having babies earlier), because the longer period of time women are exposed to hazardous substances, the more difficult it is (conception). They (her colleagues) unfortunately had several different health problems, especially from the past, which were just gynaecological. (5/CEBE/28/s/0chi/w)*

Quitting lab work and – switching to office or administrative work or taking sick leave – definitely was not an easy step for these women. Firstly, they could not progress either with their PhD-, nor with their job-related research: dissertation topics requiring special knowledge could not be passed on to other students, or they did not want others to continue their work, but more often, the topic was devaluated during their career break and women had to start the work almost from the beginning with a new topic. Secondly, a few of them faced colleagues' negative attitudes, who had to take over their tasks and became extremely overburdened. Meanwhile, I encountered social support as well, when colleagues undertook one's labwork, whose health – fertility – was already at stake. Thirdly, a pregnant student working at a pharmaceutical company reported the negative attitude of the management: they "disliked it" when women became pregnant, and it was quite a favour to offer non-lab work to them. Problems accumulated in those cases when a researcher did not have her own office, which was typical among PhD students) and was forced to work in laboratories even during in-silico or paperwork:

Well, that girl was very scared, very afraid of what might happen to her during her pregnancy, [...] she soon told her boss that she was pregnant so she could be kept away from the lab. That was a favour of mercy and lasted for about a year. They are certainly not happy about anybody falling pregnant. (14/CEBE/29/m/preg/w)

Childless women – especially those who were pregnant – in our research also gave a considerable thought to how they would be able to reintegrate after childbirth, and the majority could not foresee how they would balance work and family life and how it would affect their professional progress. Some explained that adequate safety equipment in the labs might indeed allow women to continue lab work after childbirth and during breastfeeding. Nevertheless, PhD students (and others) often worked in labs as we saw, equipped with old and obsolete air vents or without vents, which did not allow such an option for them.

Not all the students perceived risk as equally high in this sample. Risk of lab work was perceived and handled "lightly" in many cases both by individuals and institutions. Though it is the task and responsibility of the institutions to keep the rules and provide safe working conditions, it was not always the case in our sample. Based on students' experience, organisations and researchers in the private sector seemed to be more "rule follower" – supposedly because they were more frequently checked by the authorities. While in universities, despite of the regulations, lab work during the risk period seemed to be a quite usual practice for students, as an older engineer, mother of two children described it:

In academic research, it is not in the first place, there [...] everyone can do whatever they want. These (rules) exist in theory. Whether you're going to go to the lab or not, no one's going to see if you're going to go in there. (15/CEBE/31/m/2chi/w)

In some cases, students even explicitly stated that it is the individuals' own decision whether they undertake lab work during pregnancy or not. Several interviewees shared how their pregnant colleagues even with huge tummies worked "happily" in the lab when they believed they were alone there. These examples, meanwhile, hint that students were well aware of rule-breaking, but no one controlled their activity. Finally, in also one case, not just the lack of institutional control was found but the heavy violation of regulations by the institution: the chemical engineer mother of the three young children in this sample shared that she was ordered by the head of the department to undertake laboratory work during pregnancy. It was her "sheer luck" that finally, the head of the laboratory assessed the situation and "spared" the pregnant women from performing the task.

7.3.2 Chilly or warm climate?

Chemical, bio- and environment engineer (CEBE) students scarcely, but almost all electrical and informatics engineer (EIE) women were eager to share their abundance of different negative experiences stemming from the fact that they had been learning and working in the male-dominated field of engineering. These experiences – directly and indirectly – negatively influenced the harmonisation of their work and private life. Pursuing a highly masculine profession, for example, directly affected both their forming and maintenance of established partnerships. Many of them shared how their several trysts ended at the point when their dates became alarmed when they had told them of their occupation. Therefore, in some cases, these female PhD students hid this information in order to avoid work-life conflicts, as this young and single engineer women explained it:

Well, what I have experienced many times is that when we met a new person, the getting to know each other pretty much stopped when they found out exactly what we were studying, ... then suddenly they were frightened of it. (21/EIE/26/s/0chi/w)

A direct effect was detected in the case of established partnerships when a few women described that their non-engineer partner felt the urge to compete with them. They continuously tried to prove their knowledge and skills in engineering or in other masculine fields, as if they were inferior to their female partners who had "male" knowledge. These women struggled with their partners to make them understand that they expected support from them instead of competition. They also highlighted how this attitude was mainly attributed to Hungarian men; they did not experience it in the case of their counterparts in western countries. Another single informatics engineer explicitly excluded this conflict from her private sphere by not dating men at all who did not share her idea of equality. She already had to compete with dozens of male colleagues in her workplace daily, therefore, and she did not want to continue the fight at home. She also described a direct negative work-to-family spillover, because the irritation that had evolved in her towards men at the workplace became a permanent feeling in her private life:

I go into work in the morning, and I'm going to more or less have to compete with 60 men and then, when I'm going home I don't want to have to compete anymore. And then I'm irritated by the poor one (the partner). It takes a supportive partner, a normal one I see as an equal. (19/EIE/27/s/0chi/w)

She recalled an example of a blunt provocation at her university: when she had entered a conference room to start her presentation, a group of male colleagues openly stated that they did not believe in gender equality. As this insult, the majority of negative experiences also took place at university and/or in workplace environments. Female electrical and informatics engineers PhD students also very often faced the masculine view of science at their enrolments and during their higher education studies. They frequently received cynical remarks that they should have studied a different, "feminine" profession, because engineering is a male one, therefore it is not suitable for women. The most salient microaggression these women encountered was the devaluation of their knowledge and ability as engineer students and researchers. In most cases, this happened publicly, for example as this incident – even with this older informatics engineer working as a colleague at the university, who also had a business experience, running an NGO herself – just before an oral exam: the male professor explicitly stated that she had nothing to do with this exam for better grades, because it is shameful for the male kind if a woman can get an A or a B grade in mathematics.

> *In the maths comprehensive exams [=szigorlat], I took an oral to try and get a four or a five [top grades B or A], and that is when the professor told me that I should be ashamed. And all this while looking at me as if I was some kind of street sex-worker. ... He told me he wouldn't recommend me go back, because it is not a shame to a man – and again that word shame – that a woman can get a four [B] or a five [A] in maths. (20/EIE/33/c/0chi/w)*

In some cases, devaluation happened privately. This informatics engineer woman shared how her senior male professor tried to mask his biased attitude by showing a favour – wrapped in humour – to her, when allowed a remark that women do not understand mathematics, except her. *One of my bosses said the other day in the corridor that women don't know anything about IT, nobody, except me. (19/EIE/27/s/0chi/w)* A few students, however, perceived positive discrimination of women regarding the evaluation their knowledge. They considered some of their peers as silly, who, despite their silliness – always received the A grade. At the same time, they believed that they got their A grade based on merit. This is a typical example of distancing; these women also devaluated their female peers by distancing themselves from the "silly ones" (Rhoton 2011). Positive discrimination and attitudes on behalf of the faculty also appeared in other interview texts, but sporadically. A few students mentioned that women recently have had more opportunities for gaining fellowships or attending conferences and summer courses, because there is an intention on behalf of the management to ameliorate the statistics on women.

In other cases, the devaluation was less open, just wrapped in hints, such as when the achievement of a female informatics engineers was evaluated at the end of their first PhD semester. One was accused of not inviting her boss to the event, because "at least he was a man". This professor later threatened her that he would randomly check her at her workplace in order to find shortcomings and to get her dismissed. This man was already known in the university as a professor who aimed to have women sacked. Despite his bad reputation, none of his colleagues dared to oppose this colleague openly face-to-face. Only one of them tried to mitigate the incident; he went after the girl and apologised for the incident, privately. Fortunately, this woman later worked with a male senior professor who favoured working with women and he voted in favour of women (hiring, promotion, board membership). This positive support helped her to continue her career in engineering.

The devaluation of women's knowledge – and of women as humans at all – often went hand to hand with their unfair and humiliating treatment according to the interviewees. Women cited several incidents, similarly to the following informatics engineer:

> *I went to work for a firm, and it was very shocking. [...] they were very obscene, they were talking about things like that, and they took a pen drive to show how they would do it to somebody, and then they threw it on the floor. (19/EIE/27/s/0chi/w)*

An informatics engineers, quoted above, for example, was accused of cheating in the exam in front of two-hundred male peers and had to show her body in a light summer dress to prove she did not hide any cheat sheets in her dress. Her words hinted that she considered this affair as minor but at the same time she was also sure that similar incidents would follow in her career – provided she could manage it – obtaining the degree. Incidents reported from the private sector were less often mentioned (the majority of the students worked at the university), but this woman recalled her extremely humiliating treatment by men at a company she worked for, including vulgar discourses.

Some women highlighted that the devaluation of women's knowledge and unequal treatment engendered the lack of acknowledgement of their professional work. They concluded that women in their profession usually had to perform more than men to receive acknowledgement across all career stages, from Master's, through PhD studies and later on in the labour market. Based on her experiences she also alluded that women had to perform even better in the case of those very few female teachers because they – being also women – could better secure and maintain their acknowledgement in this way.

I once asked one of the heads of department if I could be successful as a woman in this career, and they said it depends on my definition of success. So there are some rough things here, you have to fight hard here. [...] You really have to tighten your belt if you really want a career as well as a family, but I think you can do it. We will find out in a couple of years. (19/EIE/27/s/0chi/w)

What is particularly important to my research focus is that the majority of these women had already realised that the demand to always perform at more than 100 percent – because they are women and because engineering is a knowledge-intensive profession –, as well fight for equality in male-dominated environments are exhausting and conflicting in the long run and are hardly reconcilable with family goals. The more conscious women in the present research even already foresaw that these demands would constrain their opportunity for success and career advancement in the future.

Finally, a group of electrical and informatics engineering PhD students in this research experienced isolation in their environment, as it is frequently described in international literature (Maranto – Griffin 2011, Settles et al. 2013). The extremely low proportion of women in electronics and informatics engineering was tangible in their their accounts. They had almost only male teachers, bosses and peers, and cited female colleagues only working in administrative or supporting divisions. Isolation, firstly, appeared in relation to friends, for example this woman felt isolated because she could not form friendships with other women in the university, and she was also not able to discuss her every-day problems with her male friends.

I only have very few female friends because of this for example. [...] So it is a kind of isolation for me in a way. (21/EIE/26/s/0chi/w)

Moreover, a behaviour-based work-to-life conflict and also a negative spillover emerged when she became isolated from her friends in her private sphere, because her female friends could not understand her "male thinking". Similarly, another PhD student also lost her non-engineer friends in the private sphere due to long working hours she spent at the university, which refers to a time-based work-to-life conflict beyond the issue of isolation.

Isolation, secondly, derived from women's constrained opportunity for finding female role models whom they could follow or from whom they might receive support. Only a few students mentioned some very few examples of female senior researchers with whom they had interacted in any way. Their experiences were positive, regarding their opinion or personal attachments to

them. Meanwhile, they described these few senior female researchers as overburdened and exhausted, regardless of which sector they worked in. This did not send positive messages towards these female students concerning the reconciliation of work and family life. In one case, a PhD student was wondering during the interview how it was that a senior woman she mentioned had achieved her position and had a family at the same time, moreover, even had a longer international experience.

> *Most of the women who taught us or whom we met in the industry were very upset, overwhelmed, nervous, disillusioned people. By comparison, the first encounter with XY was a complete shock that there is such a woman who has go, who wants something and does not look like she is 50 years old. And that is possible? And what did she do to achieve that? (14/CEBE/29/m/preg/w)*

Thirdly, isolation in a few cases manifested in women's exclusion from informal networks in their schools and workplaces. Since important information was circulated in these networks, they missed some advantageous career-related opportunities. It was typically the case of the boys' club when this married electrical engineer was not invited to have lunch with the "boys", in spite of the fact that her husband also worked there. Even her husband was excluded in this way: he chose to support his wife and had lunch with her and those who "did not belong to the club": other female researchers, secretaries and post delivery people.

> *I have lunch with the secretaries and the post delivery people every day as well as with my husband, ... I said this so that they wouldn't crush me, or send me to Coventry [socially exclude] just because if I am a woman, ... [if that were to happen then] you will miss information ... and then I may not be aware of, for example, the possibilities [of advancement and promotion]. (24/EIE/25/m/0chi/w)*

It is a fruitful thought that this woman was pondering during the interview whether she would have had a more advantageous position in the workplace, or her male colleagues would have been more kind to her if she had not been married. She also shared that by exclusion from informal networks she also faced income loss, because she did not belong to groups of which members were frequently charged with managing well-paid projects. Interestingly, in spite of her experiences described above, she perceived and reported gender equality in her environment: *But I think there is a total equality here, there is only difference in some details. (24/EIE/25/m/0chi/w)* Meanwhile, others also found it unfair that well-paid project work was assigned on a gender basis in the university departments.

But it is tolerated that they are unreliable and in return they get the interesting project, ... And, of course, he does that when there is a lot of money for it, and this really digusts me. (16/EIE/26/c/0chi/w)

Females were more likely to be charged with administrative tasks, because males were considered to be unreliable for the work. This attitude was accepted by the head of the department, nevertheless, men were much more likely to receive both professionally and financially promising projects.

Regarding coping strategies these women developed, there were two ways of how they were coping with these negative experiences. I will highlight them through the examples of two women with pseudo names. The first strategy was better spread. Based on stories Alina *(nr 22, 32 years old married and childless electrical engineer working at the university)* shared during the interview she evolved her intention "to become one of the boys": to assimilate both intentionally and unintentionally. Though she would have loved to wear womanish clothes, she decided she would rather not; she controlled her verbal and meta-communication not to behave girlishly in order to distance herself from other women and receive male acknowledgement. Alina perceived gender equality in her male-dominated environment in the university and also cited examples – which she considered as positive discrimination –, for example receiving unique attention from their male superiors or peers, who brought them chocolate and opened the door for them.

Lizzy *(nr 19, 27 years old single and childless informatics engineer working at the university and running a business in the private sector)* found another way of coping. Her strategy was less salient among students, who usually did not dare or could not protest against inequality. Lizzy was a headstrong woman with research experience in a western country. She realised she could only fight against negative discrimination and treatment provided her male peers did not perceive her as an opponent. *You have to be very knowing in such a way that they don't notice that you are in the know.* She also noticed that men in groups could be more aggressive.Therefore, she hid her personality and behaved completely differently than in her private life or than Alina behaved. She was intentionally acting girlishly – laughed, made jokes and acted if she was always happy and optimistic – in order to deceive the boys and avoid conflicts. This obviously was a typical behaviour-based conflict (Greenhaus – Beutell 1985), but it also served as a segmentation strategy with which she tried to avoid the flow of negative spillovers and information from family to work. Letting her colleagues know about her vital tasks in her private life – for example caring for an elderly family member – would have called

their attention to how conscious and responsible she was. Lizzy also learnt to delay her reaction to unfair treatment in order to requit it later, with humour. She avoided reacting aggressively, because it would have been considered by her environment as a "female tantrum".

> *Because if a man is grumpy, then he is at most aggressive, but if a woman is grumpy, then she is hysterical. You have to do it right. With good humour or not at all. [...] I have to speak out, ... Because say that ten out of a hundred people are these tiny mini male chauvinists and a girl goes into their lab, she thinks, because her boss said, "Okay, that is how they behave." ... But if they had one of those daughters themselves, they would change immediately. (19/EIE/27/s/0chi/w)*

She also aimed to sensitise her male-chauvinist boss; an aim by which she wanted to make a change and also become a role model for her peers and students. She concluded – as some of the other PhD students – that these men with high prejudice would probably convert if they would have a personal experience in family.

Finally, the majority of these female PhD students had already encountered negative experiences during their undergraduate education. Therefore, they may have already built up a kind of survival strategy in science; a resiliency that helped them to achieve success through their academic life-course even before entering PhD education (Shin – Kelly 2015, Máté 2021). Though undergraduate education is not the focus of my research, the following harsh example helps to understand the extreme challenges female students can face in STEM fields, which can strenghten both their persistence, but rather their abandonment of science. Moreover, this example also calls the attention to the role of religion in WLB and attrition of women in science. One of the interviewees who graduated as an engineer from a university that belonged to a significant church in Hungary shared a vivid memory of her education; a perfect example of the hidden curricula.

> *There was a priest when I was an undergraduate who said that women become masculine and infertile because they learn science and engineering and want to have a career and become a man. He also said that I need this PhD because I want to to shine in my own glory in front of others. (26/EIE/33/m/0chi/w)*

She explained how a priest – who was a former teacher of the university – gave lectures between classes in the community rooms and accused women students of pursuing an engineering career. He predicted several problems and conflicts between work/education and family spheres by stating that women had better not to learn, not to want to became men by learning, because it makes them infertile and their husbands would leave them in the end.

7.4 PhD and childbearing

This sub-chapter gives answers to the third research sub-question of the dissertation: *How do institutional and normative contexts shape these female PhD students' family plans, especially the timing of motherhood?* The timing of motherhood especially challenges the WLB of highly educated women, for establishing a family and starting off a career occur broadly in the same life period (Hewlett et al. 2008, Mason et al., 2013). The intersection of multiple life events – private life, education, work and childbearing – were indeed demanding for PhD students in this sample. Based on the interviews it became obvious that even if students perceived their lives as quite balanced, childbearing definitely had changed or would change this equilibrium. Our interviewees were aged between 24 and 33 years. One quarter of them were young mothers (5) or pregnant (2) at the time of the interview (all chemical or bioengineer), and the others – with one exception – planned to become a mother in the near future. The timing of motherhood was therefore a fraught issue for all these young women engineers, who were eager to share their dilemmas and concerns which had been worrying them for months or years. Even this very young chemical engineer, even not yet present in the labour market, perceived the issue staggering: *Well, this is one of my main problems. So I can easily confess I have been pondering on it for years, but especially in the past couple of months. (8/CEBE/25/c/0chi/0w)* They especially pondered at what age they should or could become a parent, when they could interrupt their professional career, how they would be able to reconcile childbearing with education and/or work and how they could reintegrate into the labour market afterwards.

In the following, firstly, students' family plans and the normative contexts will be introduced, then the chapter focuses on what age or period students found "ideal" – more precisely, less bad – to become a mother. Pros and cons of the timing of motherhood will be discussed through whether it occurs before, during or after PhD education. I am aware that retrospective data are always biased, therefore one should handle them with care. Nevertheless, I presumed that the timing of motherhood is a significant and ongoing life event of these women, therefore their memory about it should not be strongly biased.

7.4.1 Family plans and the normative context

In the majority of cases (20) PhD students aimed to have two or three children. Some of them planned to have one child, and a young mother with two, and another with three children wished to have four children. Students often gave explanations for their wish to have more or, conversely, fewer children. Firstly, they aimed to have a second or third child in order to have a sibling to their existing children, or they grew up in large families and wanted to follow this pattern. Those who planned three or more children were mainly CEBE students, including all the five mothers in the sample. EIE students (all childless), however, clearly opted for fewer children, and several shared that women's intentional childlessness was a widespread pattern in their occupation. Secondly, in several cases, they were not sure of the exact number of the planned childen. They allowed themselves to "re-think", "re-evaluate" particularly their WLB, but also their financial situation, and the personality of the child(ren) after their (last) childbearing. A mother has already decreased her three-child intention to two children when she saw the difficulties of harmonising her work, PhD and family life. Later she was quite straightforward and concluded that childbearing was a serious obstacle to her career.

Regarding the norms of the share of household chores and childcare responsibilities, childless women with partners seemed to share household chores in a more egalitarian way. A few mothers also reported a more modern, quite equitable share of family-related tasks or considered their partners as caring fathers. Meanwhile, during the deeper inquiry it manifested that these men were considered as caring fathers because they at least had arrived home to bath the children and have a family dinner before they engaged with the night shift work at home. Mothers in this sample rather featured a quite traditional share of household chores and the very traditional primary caregiver role as mothers. They also sought some support from their family of origin, such as parents or sometime their siblings to take care of the children, but paid services hardly occurred.

> I think a woman should support a man and take things like that off his shoulders. Night feeding and all that... traditional male-female roles must be maintained at some level so that we can keep or operate a family. (2/CEBE/28/m/1chi/w)

Only one mother was an exception, whose partner was a lower educated man with lower income. They shared household tasks, and the father was also an active father who often took care of the child, and he was even on one-year parental leave, which is still very rare in Hungary. The mother of the three young children honestly shared that her first child had behavioural problems which she devoted to the fact that she had to go back to work sooner than the three-

year parental leave. She was and would be, therefore, on the maximum length of the parental leave with her second and third children.

PhD students' perceptions on motherhood and its timing were strongly based on social norms and shared expectations. They were often under pressure from their families and sometimes from colleagues concerning finally when they would become mothers. The timing of motherhood was influenced by how they perceived their biological clock and motherhood-related age norms that stemmed from students' environment. But they also particularly emphasised that the timing vastly depended on how they would be able to reconcile work and family life.

> *There may also be a 30-something panic thing, or that a lot of people around me have it, and that I can see more closely what it's like, what (WLB) problems can be, and I think it also affects whether people want it to be for them or when. (24/EIE/25/m/0chi/w)*

The strength of age norms became transparent when we asked them about the "ideal" timing of motherhood if a woman aims to obtain a PhD. Though women in this sample often failed the deadline for motherhood they had set for themselves, they had quite firm opinions on the "too early", "ideal" or "too late" ages for motherhood. There was strong agreement among students that motherhood during MSc studies – under the age of 23 – is "too early" to establish a family. The majority considered the age period of 25-30 as an "ideal age" for motherhood and "too late" to have their first child in their thirties. The age of 30, as a turning point of their life course often manifested, as was the case in Mynarska's (2010) empirical findings. Finally, all these women considered the age of 40 definitely too old for family establishment. In terms of men, women hinted that their male colleagues could become fathers regardless to their age.

Traces of "sequencing norms" were also detected that prescribe the order of life events in individuals' lives (Marini 1984). Several students found it important to have an own place to live before marriage or have a job and marriage before childbearing. They often perceived high social pressure regarding the timing and sequence of marriage and parenthood, particularly from the family, and they often voiced their anger at why their environment felt authorised to have a say in it, and contrasted that situation with men, who were never asked about their fatherhood. Meanwhile, this 33 years old electronics engineer woman was often picked by colleagues about not yet having a baby since she was already married. She was irritated by their straightforwardness:

I always get at my workplace that since you already have a husband you can go to give birth to a child, which would be such better. But there's really nobody else doing this [...] everyone is somehow trying to close stages. (26/EIE/33/m/0chi/w)

Her words echo the vast majority of the students' opinion: there was also a sequencing norm of how the milestones of individual and academic career should follow each other in the interviewees' lives: they almost unanimous agreed that women ought to finish school before becoming a mother. This was clearly evident in the case of graduation years, and in the majority of the cases they shared this opinion in relation to PhD education as well.

Our standpoint as a family was that until I had a degree in my hand, I couldn't go home with a child. I wasn't alone in this, it was how all my female friends came to university. (11/CEBE/29/m/0chi/w)

Meanwhile, a few students considered those of their colleagues "careerist", who engaged in the lock-step career advancement and therefore postponed childbearing (Mavriplis 2010).

The most significant dilemma for female PhD students related to the timing of their first child can be strongly traced back to the tension between the defining social norm, biological clock and the perceived feasibility of their family plans. On the one hand, the social pressure of the completion of educational qualifications before childbearing pushed them towards the delay of motherhood. On the other hand, PhD education involves an additional three-year enrolment, but students were well aware of the fact that obtaining their degree would take 2-3 additional years – which was a general phenomenon in their academic environment. This means that they are typically at least around 28-32 when they obtain their PhD, which is the overall case in post-graduate education (NSF 2019). However, as we already introduced above, they considered the age of over thirty "too old" to become a mother and they worried they would "run out of time" as far as the "ideal" age of motherhood is concerned. Exploring our interview partners' fertility-related plans and experiences in details became obvious that though finishing school prior childbearing played a less constraning role in case of PhD education, delayed motherhood due to PhD education was still a widespread pattern. The following interview excerpt of a married but childless chemical engineer well hihlights the dilemma and social pressure she and her several peers felt.

It is obvious if someone starts to work after graduation (and does not enrol in a PhD), then her life will be completely different. For example, she should not count (the years) and feel that it would be great to give birth to a child at least till the age of 30. (9/CEBE/28/m/0chi/w)

Those in their twenties drew the age of 30 as a deadline for realising their fertility intention, those over thirty limited it up to the age of 40. Meanwhile, several of them sighed during the interview that they had already failed the original deadline they set themselves in their younger years. They also often confessed that they believed they would have more (not just one but two or three) children in their age now (at the time of the interview), but had seemingly already failed at it. This delay can be an explanation of why some students found it acceptable – for their own timing – to have their first child between 30-35 instead of the "ideal" 25-30, described above.

Finally, several students mentioned that the timing – and usually the delay – of motherhood could be rather devoted to the problem of finding an agreeable partner – a hindering factor we described in the previous chapter. However, in sum, women cannot delay motherhood for an indefinite time. The issue of the "good" timing therefore had an utmost importance for the interviewees, a result that reflects on Jacobs and Winslow's conclusion (2004) that women in academia can hardly delay childbirth until receiving tenure.

7.4.2   When is it ideal?

As we saw, the timing of motherhood was a central issue for almost all woman engineers in our sample, they had painful dilemmas on how they would integrate motherhood into their career. The majority of them would have loved to have finished their PhD before becoming a mother, but in this case, they would have considered themselves "too old" for it. A high level of uncertainty around a career break also made the timing troublesome, because of the limited availability of permanent positions. Uncertainty due to short-term contracts introduced earlier in chapter 7.2.3 made childbearing completely incalculable and insecure in their lives. Facing these irreconcilable expectations led the majority of these women to the conclusion that there is no "ideal" age for childbearing in academic careers. From the interviews it became evident that students could not find the best option; no matter what strategies a young researcher chooses for the timing, all of them are far from "ideal" and not suitable for professional careers.

Students therefore pondered the advantages and disadvantages of career breaks relevant to their present academic milestone: before, during and after PhD. Severe dilemmas arose when these options were considered deeply, and students named their "least bad options" as follows: less than one third (11) found the graduate programme suitable for childbearing, another less than one third (10) suggested that one should finish their PhD before childbearing, and only very few (2) students found motherhood suitable between MSc and PhD studies. A few (3) students found the decision so hard and uncertain that were unable to identify even any "least bad" options –

interestingly, they were mainly those of pregnant students. Finally, since there is no ideal period, another few (3) women considered all the three periods are suitable for childbearing. An electronics engineer also highlighted how the knowledge-intensivity of engineering does not allow any career break for professionals, especially one as long as a parental leave, let alone the maximum of three years. *I don't think there is ever a point where I can rest in this profession. It doesn't matter whether you do or not. (23/EIE/27/s/0chi/w)* These difficulties and the high uncertainty in the outcomes of decisions are in harmony with earlier findings of Castaño and Webster (2011), that young mothers' decisions are shaped more by social and normative pressures, rather than by their perceived best choices.

The next three sub-chapters will discuss in detail the advantages (pro) and disadvantages (cons) of becoming a mother a) before PhD, b) during PhD, c) after PhD.

7.4.2.1 Before PhD

Pros before Very few women (2) considered this period ideal, where a PhD can be a good transition, a less demanding task than (re)integration into the labour market. But they also highlighted that childbearing and WLB in this period can only be realised provided the mother had adequate family support, particularly grandparents. This well shows how they consider caregiving as a mainly female responsibility and also how support is needed. A pregnant student also suggested this period in the light of her work-family imbalance even before delivering her child. They also reasoned that younger mothers have better stamina, which is absolutely needed for both childbearing and child raising. Finally, it is worth considering that the idea of "the sooner the better to have children due to the cumulative effects of hazardous chemicals" (see chapter 7.3.1 on laboratory work) never appeared again when these women reasoned for this option.

Cons before Career break before the PhD studies (after university graduation) seemed to be the "worst" timing for students. Women in our sample scarcely remembered any example of PhD enrolment after childbearing, and, interestingly, they would find these women "too old" for a PhD. We identified the strong requirement of lock-step advancement behind these opinions (in accordance with findings of Probert, 2005; Haynes et al., 2012; Martinez et al. 2013). Most of the students had enrolled in a PhD programme in the academic year following university graduation due to the influence of their supervisors or other senior colleagues, which did not allow them to even consider any career break between degrees. From the family side, a few women shared their parents' opinion of "live first then have children". They (and their friends) suggested the age of 30 as ideal for them to become a mother, and highlighted that in this way

they would have time for themselves, for travel etc. Moreover, some students definitely suggested that young researchers ought to have some labour market experience before childbearing. This married 29 years old chemical engineer delayed her motherhood particularly due to this reason:

> *For a woman obtaining her diploma but not finding a job it is a bit like committing a crime against herself. Especially if a mother with small children applies for a post without any work experience, she will be in a difficult situation. (11/CEBE/29/m/0chi/w)*

For them, without any labour market experience it seemed to be "suicide" to become a mother – regarding the difficulties of reintegration into the labour market. Finally, a mother proposed that not having any kind of professional commitment, such as PhD or a job, during childbearing often weakens the attachment and motivation to professional work.

7.4.2.2 During PhD

Pros during Less than one third (11) of the students found the graduate programme in a few cases a "possibly good" and in more cases a "least bad" life period for childbearing, including the majority of young mothers. Students reasoning for the "possibly good option" typically considered the second half of their twenties an "ideal" period for having their first child, and over 30 "too late" for it. Therefore, the years of PhD education seemed to be a good option for them as far as the ideal age was concerned. They further reasoned that a career break during PhD would allow them to reintegrate into work more easily. Doctoral schools provide more flexible working conditions, which enhance WLB, and also some professional experience before taking the break. A mother of two children working at a pharmaceutical company highlighted that women could take a longer career break due to childbearing and be more with their family than in the private sector, which is an advantage of having a baby during PhD education. She also noted that this advantage could overcome the uncertainty they would face in the labour market. Others, working in the public sector receiving lower wages, better emphasised the need for marital support and adequate financial background for becoming a parent during studies, as we already elucidated in chapter 7.2.3 on labour market uncertainty. This young chemical engineer who did not have any income well summarised that women typically need a well-paid husband (typically working in the businesss sector) if they want to become mothers during their studies:

But those young people I see giving birth during their PhD, behind everyone there is a certain secure background, say an older husband who already works, and who can keep the family so that she doesn't have to deal with anything else. (1/CEBE/24/s/0chi/0w)

Finally, a pregnant woman revealed that she opted for childbearing during PhD, because she was uncertain whether she would be able to conceive at all, and she did not want to delay motherhood until receiving the degree.

Students reasoning for a career break during PhD as a "least bad option" all strongly perceived they would be too old to be a mother if they were to finish their PhD prior to childbearing. Finishing school before childbearing seemed to play a somewhat less significant role in students' lives at post graduate level. Based on the interviews, we found that this norm prevailed during PhD education, but, after a certain age, it was overcome by a stronger pressure, namely by women's biological clock. The pressure of having children before growing too old was more intense in the case of those students who enrolled in the PhD programme later than the typical age of 23-24 (after university graduation). For them, not just the "ideal period" but of becoming a mother will certainly overlap with their studies no matter how fast they try to finish it. Therefore they accepted having their first child during the PhD education as a "least bad" option. *'I do not consider finishing the PhD before childbearing obligatory anymore, since I am old enough for childbearing. (7/CEBE/31/s/0chi/w-pa)*

The health factor played a vital role in their decision. The perception of high level biological risks of childbirth at a later age – after 35 and 40 – also drove them to have their first child within a short time. This 31-year-old student therefore planned to have two children between the ages of 32 and 35, which shows how the period of fertility shortens for higher educated women who typically become mothers over 30 (Spéder 2021) .

I definitely want to stop because I feel like I don't want to wait any longer, especially if I want to have more children, I feel like I don't have time anymore. I don't want to be a very old parent, and considering the health risks, I really set myself a limit on when. So next year, actually, at 32. (26/EIE/33/m/0chi/w)

Nevertheless, PhD enrolment is for a long period of time. According to the interviewees – who voted for childbearing during PhD – not every period of it is suitable for childbearing. One third of these students found only the last period of the PhD course – dissertation writing – suitable for it. This is the period when they are over the high stress of exams and the laboratory work.

Meanwhile, these opinions are based on experiences of a few others, therefore they often just guessed what would be right for them. A few women, for example, already changed their opinion about the seemingly ideal period of childbearing during dissertation writing, for they foresaw the high levels of stress the defence of the thesis can imply for them.

Cons during Analysing the interviews, we encountered severe disadvantages of childbearing during PhD. It is meaningful that the reason why several women voted for childbearing after PhD – or even before it – as a least bad option, was that they found PhD education hardly reconcilable with childbearing. This opinion was widely shared, particularly among married PhD students working in parallel with their studies. Childless PhD students highlighted that they already faced time squeeze, let alone if they would have had children. Several of them, as this married, childless chemical engineer, were also wondering how it was manageable at all for anyone:

> *Although I don't have any children yet, sometimes I have no idea which way to look. […] I really don't have a clue how I will manage all that. I think if you have a job, and also do a PhD and have a kid, you will easily lose control. It's very difficult to do a PhD and raise children as well as work. I don't even know anyone who could pull it off. (11/CEBE/29/m/0chi/w)*

 A pregnant woman who had been working at a pharmaceutical company for six years also hardly knew any women who had successfully raised a child during PhD and had worked in industry at the same time. She described as "wonderful" and "superwomen" those who nevertheless managed it. Beyond the time squeeze, some women reported that they were not capable of managing childbearing and work-life balance during PhD due to the high level of strain-based WFCs. *I'm so stressed about everything, exam period, deadlines, so I am not capable of this (childbearing). (9/CEBE/28/m/0chi/w).* Finally, PhD students also had difficulties in taking a career break during PhD, because they usually were already engaged by industrial partners with fixed-term work contracts through their departments.

Concerns of childless students were not groundless, the actual WLB of young mothers in this sample was less favourable. The time squeeze often forced them to choose between work and family. The following mother was in full employment at the university after her maternity leave and stress was a daily presence in her life. She found the time squeeze unsolvable in spite of having a partner who took his share of the household chores. Her words also tell us that family tasks were not equally shared between the partners, but quite better balanced than is usual in Hungary.

My day is always full of continuous stress and hurry. [...] I suffer from continuous lack of time, and I am afraid that it could be solved only if a day was 34 hours instead of 24. I see this as quite unsolvable, though my partner takes his share of household chores, at least to the extent you can expect from a man. (3/CEBE/31/c/1chi/w)

Regulations of doctoral schools also did not support childbearing during PhD studies. A mother of three children bitterly experienced the rigidity of the regulations and those of male stakeholders. Students can delay only four semesters in a row, during which delivering and raising, for example, two to three children is impossible, let alone in Hungary, where women spend more time – compared to six weeks, for example, in the USA – at home after delivering. Having only one child is also impossible if somebody aims to use the maximum period of maternity leave, which is three years in Hungary. Many PhD students highlighted that regulations are typically written and also kept by male professors, who are not sensitised towards gender equality. It was also mentioned a couple of times that their sensitisation might occur if they were to become involved personally, for example when their daughter who works at the same workplace would become a mother and would face these structural constraints. This mother of three children indeed had couple of experiences about the phenomenon:

Those who are there are usually men, old men who are there in their corners, have no direct experience, unless, just then, their grandchildren and their children are born there. Older professors don't perceive that kind of thing, and that's why they don't care. With my request for the final comphrehensive exam was refused on the grounds that it would set a precedent. But how many people with three kids want a PhD?! (13/CEBE/33/m/3chi/w)

Many female PhD students called attention to the issue that women who had children during PhD tended to lose their motivation for finishing their PhD. Firstly because they are forced to find a job in parallel with their PhD to secure their financial situation, which further hinders their WLB. The vicious circle of mommy track and delayed PhD was well described by this interviewee who saw several mothers in PhD education, who were *"there every year, and after a while, she is going to have pay tuition, and she is never going to finish it, and then she is going to earn even less money and work even more." (22/E/32/m/0chi/w-pu)* Secondly, many students emphasised that mothers in their professional environment tend to lose their motivation for research and obtaining their degree, because in knowledge-intensive profession, such as engineering, the novelty of the research topic can become easily outdated during one or two missed semesters.

If you do motherhood conscientiously, you can pull away, and the world changes so much that it won't have any novelty value [...] So you shouldn't get left behind because progress is very fast. (22/EIE/32/m/0chi/w)

As students reminded us, progress is very fast particularly in the fields of electronics and informatics engineering and those who delay are probably left behind.

This leads us to another important factor, the issue of labour market and workplace uncertainty, that was already described in chapter 7.2.3. Uncertainty definitely had a postponing effect on fertility and the timing of childbearing – PhD students at the time of the interviews, for example, were not eligible for regular maternity leave and childcare benefits; they needed at least one year active labour market status to receive any. Finally, as we saw in chapter 7.3.1, laboratory work also played a further vital role in students' timing of motherhood. Even those students who considered PhD education suitable for childbearing, found it irreconcilable with pregnancy and breastfeeding. As we mentioned earlier, some interviewees found only the end of their PhD, the period of dissertation writing, suitable. Obviously, this was the result of the "bargain" of the conflicting social norms of the need for a finished education and having a first child at not too late an age.

7.4.2.3 After PhD

Pros after Basically, most of the PhD students would have favoured the option of having a first child *after obtaining their PhD*, but only if they had not considered it "too late" for motherhood. In fact, pondering the possibilities, only fewer than one third of the students suggested or preferred this option, regardless of how old they were at the time of the interview and when they had started their PhD. Meanwhile, they were mainly in their second or third year of enrolment, around dissertation writing, which helps to understand why they found this option acceptable. Younger respondents may not have felt the time pressure for childbearing and therefore aimed to finish school before it. Older interviewees seemed to accept "late" motherhood. The next interview text of a young chemical engineer well summarises the advantages of childbearing after obtaining the degree.

I think it's best after that, because it's not lost on the fact that you have a PhD, you don't lose your research because you've finished it, but you don't start at a disadvantage, because while you don't have any work experience, the fact that you have a PhD is good, because it's okay to quit for a little while. That would be ideal, perhaps. (1/CEBE/24/s/0chi/0w)

A few students recommended an even greater delay in childbearing: women should first find one or two post-doc jobs after PhD, have a few years of labour market experience aiming at better salary prospects and probably also a better work-life balance. These women therefore postpone childbearing up to the age of even 35. Their opinion was also based on the consideration that in order to be eligible for childcare benefits in Hungary, one should had a half year labour market position.[34] At the time the interviews they were not eligible, therefore even those delayed childbearing who otherwise would not.

Cons after In contrast with the other two options introduced above (childbearing before and during PhD), students named only one reason against become a mother only after PhD. Based on their biological clock, they perceived motherhood too late by the time of obtaining their degree. They listed several reasons against late motherhood. In the first place they all mentioned the health risks of late motherhood. They were also aware of the casuality and risk of artificial reproductive technologies (ART) as it is introduced by Szalma (2021). *I want to have the baby before 35 anyway. I don't want to have to resort to artificial reproductive technologies (ART) or things like that if I can. I've heard some really bad things about ART. (24/EIE/25/m/0chi/w)* A mother, based on her own experience, gave voice to the issue of stamina as well: *I already feel that my baby is about 7 kilos, and if she just needs cuddling when she cries, my waist will snap. And that manoeuvre is even tougher when you're 40. (2/CEBE/28/m/1chi/w)* They also considered their age in the future too old when they supposedly would become grandmothers, and also their weak stamina to take care of, and look after the grandchildren. A few of them even imagined the shame they would feel at their children graduation if they were to be found too old by others. Finally, academic life courses are gendered regarding the timing of parenthood. The majority of the interviewees concluded that men were more free to decide on their timing and postponement of fatherhood, since their fertility is not as limited as women's.

Synthetising all the pros and cons of childbearing before, during and after PhD education, it can be concluded that these female engineering students pondered their timing of motherhood both according to their preferences and constraints. One-quarter of the students (7) preferred family over their work, and their majority (two-thirds) were chemical or bioengineers. They tended to see more advantages of becoming mother during PhD education. Almost half of the PhD students (13) in the sample preferred both work and family life quite equally. They rather belonged to the goup that found the period after obtaining their degree more suitable for

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[34] This was changed after the fieldwork was completed, and students in tertiary education became eligible for maternity leave in 2015.

childbearing. Meanwhile, almost half of them (5) – also chemical or bioengineers – chose family over work because they perceived the two fields as irreconcilable. It was a fraught issue for them and they shared how they had to or would sacrifice their career. The example of this young chemical engineer well describes their concern and also highlights how male and female life courses can differ (Xie et al. 2015, Mason et al. 2013) She deliberately did not start a career in Research and Development or have her child in parallel with her PhD because she believed that a career break due to childbearing literally meant a kind of termination of her academic progress.

> *We really have everything needed for having children. […] My fiancé is all enthusiastic about it, but actually he won't have to quit his job. So when I decide that I'm willing to give up my professional career, we can immediately have a baby. This is exactly why I didn't start a career anywhere, because I felt it could have been either the career or the children. But not both at the same time. And now I still think of this way'.* (8/CEBE/25/c/0chi/0w)

A smaller group of women preferred work over family, at least at the time of the interview. All of them were electronics or informatics engineers. They slightly preferred childbearing after obtaining their degree, or emphasised that any time is suitable because there is no ideal period for childbearing in their profession.

In sum, chemical and bioengineers tended to opt for childbearing during PhD education, while electronics or informatics engineers rather finished school before – all as the least bad options for them. Examining the types of pros and cons of childbearing in different life periods, it was quite tangible during the interviews that chemical engineers highlighted dilemmas around the timing of motherhood that are more closely connected to age norms, normative pressures and work-life balance problems. Electronics and informatics engineers instead tended to mention advantages and disadvantages of childbearing before, during or after PhD education that were more closely related to the special characteristics of engineering as a profession, such as the devaluation of knowledge, decrease in professional motivation, knowledge-intensivity. They also more often considered the biological limits of childbearing, conception problems and the issue of artificial reproduction technologies (ART).

7.5 *Summary of the findings*

Female PhD students in the present research evaluated their WLB in terms of the time they could spend on their activities in their different life domains. The vast majority of them worked in parallel with their PhD studies. Those who had employment in the public sector had a partner and were childless perceived their life more balanced. Women with care responsibilities – chemical or bioengineers – or those who worked in the private sector frequently experienced work-to-family conflicts and struggled more for WLB. The high level of imbalance forced PhD students to balance their life daily, weekly, monthly and yearly, according to their main goals in their studies, work and family life.

7.5.1 Constraining and facilitating factors

One of the main constraining factors of their WLB was the heavy workload both in their studies and work. In universities and public research institutes, the massive amount of teaching activity and project-based work, in the private sector also project-based work demanded overwork. Regardless of the sector of employment, the majority (17 out of 24) of engineers reported long – typically 12-14-hour – working days and also months without days off at the weekends. The workload was especially demanding for chemical engineers at pharmaceutical companies and for informatics engineers at start-up companies. These students were pressured by organisational norms to be always present and available (regardless of time and space) and maintain high productivity. The vast majority of the PhD students were devoted and motivated researchers, eager to meet the requirements of their work and also aimed at finishing their PhD as soon as possible. Therefore, the expansion of working hours was partly employee-driven, but nevertheless, the management tended to misuse and abuse their devotion.

Two working models were distinguished among students. The first working model consisted of an all-day work shift until late at night in the department without any considerable break. Due to the lack of female role models and the pressure stemming from the departments, women – typically childless, single, or those with an engineering partner – followed this dominant "male" working model both in universities and private companies. Only after they had become exhausted or had faced too much work-life conflict had they switched to the second model and inserted some personal or family time between the daily work and the evening/night shifts at home. Childless women and mothers also tried to follow this second "female or family" working model, but most of them failed to do so in the long run. They could not invest as many hours into their professional work as men, mainly since they were also primarily responsible for caring and household tasks beyond their studies and work. While the male working model was

associated with the image of the "ideal, good researcher" and a successful career, those who could not follow it – particularly mothers – tended to be considered less devoted, secondary employees.

Engineer women in this sample could not follow either of the two working models, for both caused different work-family conflicts in their life. Almost all of them encountered time- and strain-based conflicts stemming from studies and work in their private or family lives, and often from the work-to-studies direction. The majority of the students experienced time-squeeze and soon had become overburdened, regardless of their sector of employment or in which engineering discipline they pursued their degree. Stress and bad moods generated negative work-to-family spillovers in several cases: tiredness, exhaustion and sometimes even insomnia, which recoiled upon their studies, work and performance. As a consequence, almost all of these PhD students lagged behind their home-related tasks and also their PhD research, which definitely delayed obtaining their degree. For single students, finding a stable partner was also an extra challenge due to the lack of time, and these women often completely and permanently pushed back their private life due to continuous overwork. The lack of understanding of the partner regarding the studies and work of engineer women sometimes also caused conflicts between the partners, which led to the end of their long partnership.

Female PhD students did not have well-developed coping strategies but developed and tested different useful practices by which they aimed to facilitate their WLB with greater or lesser success. To avoid work-life conflicts, only less than one-third of the interviewees, mainly those who did not work in parallel with their PhD education or worked in the public sector, managed to finish their studies or work within the official working hours. As another strategy, the majority of the students – particularly mothers – aimed to separate their studies, work and private life in terms of time, space and strains. Meanwhile, the majority of them failed to keep these fields independent from each other. The other typical strategy was to communicate the boundaries between work and private life to the gatekeepers: tutors, bosses and partners, but it implied a continuous fight, conflict and stress with gatekeepers on a weekly or monthly basis.

Adequate scheduling appeared as a strategy that enhances WLB in several cases. However, schedule control was also seen as an individual responsibility and these students had less success in it. These students often chose apartments near the university or workplace in order to decrease travelling time between work and home, particularly when their work included intensive laboratory work. PhD students also sought support from their families, mostly from their partners if they could, but every fifth of them was single at the time of the interviews. Finally,

some students reported that international mobility – PhD scholarships abroad – was also seen as a final strategy to avoid overburden and time-squeeze, which doctoral schools and workplaces often implied.

Flexible working arrangements – both PhD- and job-related – played important roles in students' WLB in the present research. All of the PhD students characterised working arrangements in the public sector with high flexibility. Flexitime and flexiplace helped them to control their schedule and to adapt working hours to private and family needs within certain limits. The sense of capability for flexibility decreased their time-squeeze, therefore their stress level and WFC. Flexitime was especially a key issue in work-*family* balance for young mothers. In universities and other public research institutes, students could schedule even part-time work with more flexibility, step by step, than their counterparts in the private sector. Meanwhile, the lack of part-time work after the age of three of the children hindered their work-family balance in the long run. Flexiplace also positively affected their WLB, when students were at liberty to work at home, when their child was sick, or as reintegration into work after childbirth. Hence, these were rather ad-hoc practices than officially arranged flexible working conditions, for there were only a few minor examples. Moreover, flexitime and flexiplace highly depended on the type of the work, since laboratory work, complicated computer analyses, teaching activities or meetings required personal attendance at the workplace. These flexible practices were scarcely found in the private sector, which was described instead as of with a high degree of rigidity by the students.

Flexibility, however, appeared as a double-edged sword in their WLB. Though it allowed PhD students to insert some family time between the day and night shifts, they tended to overstretch their working hours, which blurred the boundaries between the life spheres and caused work-family conflicts and stress in their life. Beside employee-driven, employer-driven flexibility was also a constraining factor, because it also excessively expanded students' working hours in the majority of cases. Though part-time work allowed better reintegration after childbearing, part-time workers tended to be considered less devoted students and employees in both sectors. PhD students also had to be cautious regarding flexiplace. Though they were fairly free to decide where and when they worked, personal attendance (face time) was often expected by the management. This high degree of flexibility required extensive scheduling of work and family life. Especially younger students struggled with time management, but older women also reported how they were painfully forced to learn in the first couple of years in PhD education to achieve a better WLB.

The vast majority of female engineering PhD students in the present research perceived different uncertainties stemming from the labour market and their doctoral schools, which heavily affected their WLB in various negative ways. Firstly, half of the working students were employed on fixed-term contracts, two-third of them on extremely short ones (2-12 months), which heavily hindered the harmonising of work and family life, particularly for motherhood for these women. Precarious employment forms were present in both sectors, but in the private sector, all women received fixed-term contracts. This insecurity implied continuous and severe stress in these women's life, meanwhile, their male partners in engineering or their male colleagues – with the same qualifications and the same number of finished semesters in PhD education – tended to receive more extended or permanent contracts. The low income these PhD students received was the other source of their labour market uncertainty. Neither PhD scholarships nor assistant researcher salaries were sufficient to leave the parental home and establish a family. Moreover, higher-income projects were tended to be carried out by men scientists, and women were more likely to be charged with extra, unpaid tasks for the organisations that overburdened them and left little time for professional research. In addition, at the time of the interviews, women were not eligible for maternity leave if they became mothers during PhD education.

Female PhD often considered quitting their jobs, but always stayed in the hope of a more stable status, mainly because public research institutes offered better opportunities for harmonising work and family life. This was the point when the life courses of women and men engineers started to diverge significantly because male PhD students tended to seek positions in the private sector that provided a higher income to establish a family. The third source of uncertainty in female PhD students' life that influenced their WLB was their gender-based discrimination, particularly that of mothers. Apart from contractual segregation, these women frequently voiced their fear concerning their reintegration into the labour market and PhD education after childbearing. Despite the law, they – both mothers and childless women – already encountered incidents when employers selected younger, childless professionals for the different positions or when they did not tolerate career breaks or too many days off due to family responsibilities. EIE PhD students did not, but CEBE PhD students often described the attitudes of their tutors and the management as supportive towards motherhood. At the same time, they also identified all the three sources of uncertainties, which quite confuted this supportive attitude.

7.5.2 Studying and working in engineering

Laboratory work limited women's opportunities for balancing work and family life. Laboratory work affected students' WLB in two significant negative ways. Firstly, laboratory work was often *inflexible* in terms of time, place and safety regulations both in the fields of chemical and bioengineering and electrical and informatics engineering. PhD students were usually powerless to control laboratory work. The necessary time for measurements and their results were often unpredictable, and the day-long running measurements literally could not be stopped. Laboratory capacity was also limited on weekdays, and sensitive data or safety regulations also often led to long working hours and weekend work, which curbed the harmonisation of lab work with private and family life. Secondly, laboratory work implied *health hazards* for humans, particularly in relation to childbearing, therefore laboratory work was prohibited during pregnancy.

Quitting lab work and switching to office or administrative work or taking sick leave significantly constrained female PhD students' WLB, mainly the timing of their childbearing. Even those women whose PhD or workplace research did not include lab work had to reschedule their tasks during the risk period since PhD students were assigned to teach lab-related courses and supervise students. It was also an obstacle that school regulations allowed only four consecutive inactive semesters, which curbed parental leave options even in the case of one childbirth, let alone more births. Meanwhile, they faced health risks even if they adhered to every safety regulation; examples were found of accidents that happened when they were not even aware of their pregnancy. Moreover, health risk was perceived and handled irresponsibly in many cases both by individuals and institutions, mainly since organisations shifted responsibility to individuals.

Engineer women in this research already had encountered negative experiences during their undergraduate studies, and they also reported a host of negative experiences during PhD studies stemming from the fact that they had been learning and working in the male-dominated field of engineering. These experiences – directly and indirectly – constrained the harmonisation of their work and private life. Firstly, several women hid their occupation during their trysts because their dates tended to become alarmed when they had imparted this information to them. At later partnership stages, a few of them struggled with their non-engineer partners to make them understand that they expected partner support instead of competition as if they were inferior to their female partners who had "male" knowledge. A few others described negative work-to-

family spillover, because they had to compete with dozens of male colleagues in their profession daily and irritation evolved towards men became a permanent feeling in private life.

The masculine view of science penetrated their environments, particularly in electrical and informatics engineering, where they were represented only in low numbers and proportions. They regularly received cynical remarks that they did not belong to the male word of engineering. The most salient microaggression was the devaluation of their knowledge and ability as engineering students and researchers. The majority of them felt that as a woman, they had to work more for professional acknowledgment than their male counterparts. This also explains the long working hours and their detrimental effects on their WLB. However, in a few cases in chemical and bioengineering, PhD students experienced their positive discrimination as a woman, mainly at exams and conference grants. The devaluation of women's knowledge in electrical and informatics engineering often went hand to hand with their unfair and humiliating treatment both in schools and workplaces.

A few female students also experienced isolation in their environment. They felt isolated because the lack of female peers, colleagues and role models, and also because their exclusion from informal, male-dominated networks that would have provided them with vital professional information. Moreover, their "male engineer thinking" often isolated them in their private life from their friends. Two types of coping strategies of students were distinguished as an answer to their male environments. Firstly, they tried to hide their femininity and "to become one of the boys", which led to behaviour-based work-life conflict in their life. Assimilation also included that they tend to devaluate their female peers' knowledge and distanced themselves from those women whom they found "did-not-belong" to engineering. The other strategy was less salient among students. Only a few of them recognised inequality and gender-based discrimination and tried to fight against them – mainly with humour and sensitisation of their close environment.

7.5.3   PhD and childbearing

The timing of motherhood especially challenged the WLB of these highly educated women, for establishing a family became an acute issue during their PhD studies. There were five mothers and two pregnant women in the sample, all but one student planned to become a mother, and in the majority of cases (20) they aimed to have two or three children. PhD students' perceptions on motherhood and its timing were firmly based on social norms and shared expectations of their broader and closer environments. The timing of motherhood was influenced by how they

perceived their biological clock and motherhood-related age norms and how they would be able to reconcile work and family life.

These women often failed the deadline for motherhood they had set for themselves. The majority considered the age of 25-30 as an "ideal age" and "too late" to have their first child in their thirties. The age of 30, was a turning point and they considered the age of 40 too old for family establishment. Traces of "sequencing norms" were also detected; several students found it necessary to have their own place to live before marriage or have a job and marriage before childbearing. They often perceived high social pressure regarding the timing and sequence of their life events, particularly from the family. Regarding family roles, though childless women with partners seemed to share household chores in a more egalitarian way, mothers rather featured a quite traditional share of household chores and a very traditional primary caregiver role. They sought some support only from their family of origin, but paid services hardly occurred.

Students pondered the advantages and disadvantages of career breaks relevant to their present academic milestone: before, during and after PhD. The most significant dilemma for female PhD students related to the timing of their first child can be firmly traced back to the tension between the defining social norm, the biological clock and the perceived feasibility of their family plans. On the one hand, the social pressure of completing educational qualifications before childbearing pushed them towards the delay of motherhood. On the other hand, they would typically be at least around 28-32 when they obtain their PhD, which they considered quite late for the first childbearing. Apart from age norms, the high level of uncertainty around the career break (limited availability of permanent positions, low income and gender-based discrimination of mothers), the inflexible working conditions in the private sector, the inflexibility and health hazards of laboratory work, as well as the devaluation of their knowledge during maternity leave, their stamina, labour market experience, health issues, conception problems and ART technologies at late motherhood, the stress at PhD exams, the importance of obtaining the degree all played important roles in the timing of their childbearing.

Severe dilemmas arose when these options were considered deeply, and students concluded that there is no ideal period for childbearing in their profession, therefore they named their "least bad options" as follows: less than one third (11) found the graduate programme suitable for childbearing, another less than one third (10) suggested that one should finish their PhD before delivery, and only very few (2) students found motherhood suitable between MSc and PhD studies. Their preferences also highly influenced the timing of their motherhood. One-quarter

of the students (7) preferred family over their work, the majority (two-thirds) of them were chemical or bioengineers. They tended to see more advantages of becoming a mother during PhD education. Almost half of the PhD students (13) in the sample preferred both work and family life relatively equally. They rather belonged to the group that found the period after obtaining their degree more suitable for childbearing. Meanwhile, almost half of them (5) – also chemical or bioengineers – chose family over their work only because they perceived the two fields as irreconcilable. A smaller group of women preferred work over family; all of them were electrical or informatics engineers. They slightly preferred childbearing after obtaining their degree, or emphasised that any time is suitable because there is no ideal period for childbearing in their profession.

In sum, chemical and bioengineers tended to opt for childbearing during PhD education. At the same time, electrical or informatics engineers would rather finish school before – as the least-bad options for them. Examining the types of pros and cons of childbearing in different life periods, it was quite tangible during the interviews that chemical engineers highlighted dilemmas around the timing of motherhood that are more closely connected to age norms, normative pressures and work-life balance problems. Electrical and informatics engineers instead tended to mention advantages and disadvantages of childbearing before, during or after PhD education that was more closely related to the unique characteristics of engineering as a profession, such as the devaluation of knowledge or the issue of knowledge-intensiveness. They also considered more times the biological limits of childbearing, conception problems and the issue of artificial reproduction technologies (ART).

8. DISCUSSION

The main goal of my research was to explore the WLB (work-life balance) of female PhD students in the field of engineering in Hungary. Semi-structured interviews were conducted with 27 female PhD students, and the two sub-samples included CEBE (chemical, environment and bioengineer) and EIE (electrical and informatics engineer) students. The research is embedded in a dual theoretical framework. While WLB theories (Grzywacz – Carlson 2007, Greenhaus – Beutell 1985) helped to understand the relationship of school, work, and family life, the LC (life course) approach (Huinink 2013, Moen 2011) highlighted how the critical intersection of individual and academic life courses affected PhD students' WLB, especially with respect to the timing of childbearing. I applied WLB theories and the life course perspective as interdependent, complementary theories, and the intertwined interpretation of the findings allowed for a more complex understanding of the WLB of these young female professionals.

Examining how these female PhD students interpreted their own WLB, seemed to indicate that they evaluated it in terms of the time they could spend on particular activities in different realms of life. Those with a partner, but particularly with children, reported several conflicts that could be easily identified with those of time, strain, and behaviour-based conflicts described by Greenhaus and Beutell (1985). They also frequently encountered negative, but occasionally positive spillovers (Király et al. 2015). Single students not engaged in careers tended to find their lives quite balanced even if they spent significantly more time on studies. They unambiguously put this life domain as priority in their lives, at least till obtaining their degree. This is in contrast with Greenhaus and Beutell (1985), who argued that balance occurs if individuals devote equal time to life domains without hierarchy. They perhaps perceived a 'subjective fit' between work and family despite the also perceived work-life conflicts (Voydanoff 2002). For these students, role salience in education and work domains during PhD studies seemed to fit within the framework of their goals, changed and/or evolved over time (Kalliath – Brough 2008). These result reaffirm the need for a more inclusive, component approach to WLB (Rantanen 2011). In addition, some advantages of role accumulation (Sieber 1974) were also revealed, for they found joy in their life domains being a professional or/and a mother, which enriched their lives, enhancing their WLB (Grzywacz – Marks 2000).

In sum, the vast majority of female PhD students in this sample were engaged in multiple roles: education, work, private and family life, which severely challenged their WLB. Their main concerns and dilemmas were when to integrate motherhood into an academic career and how

to balance their education/work and family life. In the following, firstly, I discuss the results of the three research sub-questions which helps to understand how dilemmas evolved in PhD students' lives and what strategies they applied accordingly. Secondly, I draw joint conclusions based on the three discussions, then highlight academic and policy contributions of the dissertation. Finally, the limitations of the research and some future research directions will be presented.

8.1   RQ1: Constraining and facilitating factors

Female PhD students in the present research were also socialising as students and employees in the greedy organisations (Ward – Wolf-Wendel 2012, Lewis – Humbert 2010, Mavriplis 2010, Moen – Sweet 2004), moreover, and were also pressured by the knowledge-intensiveness of the engineering profession. One of the most determining factors of their WLB was the heavy workload they carried both as students and as employees. Teaching activities, laboratory work, as well as short deadline projects at pharmaceutical and start-up companies were found to be especially demanding. PhD fellowships cannot provide financial independence in Hungary, and organisations also pushed students into the labour market early. This result is very much in accordance with earlier international research studies on young professionals in Europe (Friesenhahn – Beaudry 2014). The pressure for PhD students to always perform within a short period of time at a high level stemmed from the demands of both the productivity-based neoliberal academia and/or their employment in the private sector (Rosa 2021).

The heavy workload brought about long working hours for PhD students regardless of gender. Women clearly identified the dominant career model of an engineering career as a successful male research career and those who could pursue such a model, as ideal researchers (Acker 1990, Beddoes – Pawley 2014, Williams et al. 2013). Women in this sample aimed but failed to follow this model exemplified by extremely long working hours and continuous professional advancement without any considerable career breaks. Meanwhile their male counterparts seemingly could devote exclusive and undivided time, energy, devotion to their studies and work. Those students who disregarded or downright violated this devotion schema (Blair-Loy – Cech 2016) – particularly young mothers, but also those who struggled for WLB and cut off work – had been clustered into the "less acknowledged, devaluated group" of researchers by their environment. The expansion of working hours was communicated by the management and often even by the PhD students as employee-driven. Meanwhile, present results hint instead that the management tended to misuse and abuse these students' devotion for the organisations' sake. Thus, though these female PhD students experienced the phenomenon of the greedy

institutions described by scholars (Ward – Wolf-Wendel 2012, Lewis – Humbert 2010, Mavriplis 2010, Moen – Sweet 2004), with few exceptions, none of them addressed organisational responsibility. Moreover, they considered both the struggle for WLB and their failure as a 'good researcher' as their own responsibility (Moen 2011).

Heavy workloads and long working hours frequently resulted in overburden in the interviewees' lives generating work-life imbalance as scholars described in the case of female professionals (Jacobs – Gerson 2004). Though the majority of these female PhD students were devoted researchers and teachers, and the satisfaction with their professional work enriched their WLB (Grzywacz – Marks 2000, Greenhaus – Powell 2006), it did not prevent them, however, from experiencing different work-to-family conflicts (Greenhaus – Beutell 1985). Female engineers in this sample also heavily experienced the time-squeeze (Rafnsdóttir – Thamar 2013, Clarkberg – Moen 2001), strain-based conflict, stress and other health problems in their lives, similar to previous findings on PhD students (Stimpson – Filer 2011, Golde 2005, van der Lippe et al. 2006, Carter et al. 2013, Jairam – Kahl 2012). Regarding education and work, for the vast majority of the PhD students, work-life conflicts were also coupled with time-based conflicts between their studies and work. These conflicts definitely delayed obtaining their PhD and therefore their childbearing.

Interviewees continuously aimed at developing different individual strategies during their PhD education as a form of self-protection to ease the conflicts between studies, work, and family life. Boundary management (Peng et al. 2011) was predominantly applied, particularly by mothers and those with partners. Mothers were likely to aim at separating their life domains but were unsuccessful, as Mellner et al. (2014) pointed out and this failure often led to the conflicts discussed above. A few PhD students managed to suppress long working hours, but the majority of them only temporarily achieved this aim. It is meaningful that they considered it as a successful communication with the gatekeepers if they did not have to work at the weekends and during holidays. The role of adequate scheduling also appeared as a good strategy to ease the time-squeeze, as other research has called attention to that (Peng et al. 2011), but it was also seen as individual responsibility and it required omnipresent, conscious, and tiring communication with the gatekeepers. My results show that these PhD students, being women at the bottom of the academic hierarchy, had low capability to control the length of their working time and were required instead to adopt it to the toxic working environment.

Flexible working arrangements – both PhD- and job-related – played an important role in students' WLB in the present research, as it is described by several research studies (Chung

2018, Fuller – Hirsh 2018). High flexibility – flexiplace and flexitime – in the public sector allowed women to adapt working hours to private and family needs within certain limits. The sense of capability (Hobson et al. 2011) for flexibility decreased their time squeeze, therefore reducing their stress levels and work-family conflicts. On the other hand, the lack of flexibility in the private sector severely constrained women's WLB, particularly in relation to childbearing.

However, neither did increased flexible working arrangements always lead to a better WLB in these PhD students' lives, as it was highlighted in earlier research (Hobson 2011). The phenomenon of the double-edged sword (Peters et al. 2009) also appeared when both students and the organisations overstretched the working timeframe (Nagy 2020, Mullan – Wajcman 2019). Night working shifts at home often blurred the boundaries between the life spheres causing different work-to-family conflicts in their lives (Glavin – Schieman 2012, Demerouti et al. 2014). Institutions in academia were to be perceived so greedy in some cases, that women even considered switching to the private sector to find some peace and balance. Part-time employment proved to be a good strategy for the mothers to gradually re-integrate into the labour market after childbearing, but it also violated the devotion scheme of the organisation and implied a low salary. PhD students were expected to manage and schedule their own work as introduced by Tausig and Fenwick (2001) or Kelly et al. (2010), but this personal control of time shifted the responsibility to PhD students: though they were "free" to decide on how to prioritise roles, they remained alone in the struggle for WLB (Toffoletti – Starr 2016, Lewis et al. 2007). In sum, flexible working arrangements helped, but traditionalised these students' gender roles and responsibilities (Cech – Blair-Loy 2014), even in the quite gender-balanced CEBE field.

Info-communication technologies also manifested themselves as double-edge swords in WLB in the present research as well. On the one hand, they facilitated female PhD students' everyday logistics, as it was found in previous studies (Grant et al. 2013, Mullan – Wajcman 2019). On the other hand, as Dén-Nagy (2013) drew attention to it, ICTs damaged their WLB by blurring the boundaries between the life spheres. This research revealed that apart from the communication from home after working hours, ICTs also proved to be extremely helpful by allowing remote access to control laboratory experiments from home. Meanwhile, they also fostered employer-driven flexibility for the organisations' sake), which heightened the pressure on these students to be always available for the organisation (Smith et al. 2008, Hobson et al. 2011.

In line with the literature on uncertainties (Leathwood – Read 2020, Ivancheva 2019, Bernardi et al., 2008, Blossfeld et al. 2005) and the phenomenon of the neoliberal universities (Rosa 2021), labour market and workplace uncertainties crucially affected the WLB of female PhD students in this research. Women experienced the global phenomenon of precarity that has reached the highly prestigious institutions of research and development in Hungary as well. This high level of precarity made career starts as erratic for women in this research as for their western counterparts (O'Keefe – Courtois 2019). Results confirm that uncertainty is a considerable problem even in highly educated youths' lives, while the gendered nature of uncertainties and life courses is also exposed. It cannot be a surprise that I also found evidence for the widespread use of short-term contracts as well as the scarcity of tenure positions, since the proportion of precarious employment of women is the highest in the country among EU member states (She Figures 2021). Nevertheless, it is an intervention point for stakeholders, that this research found alarmingly extreme short-term contracts (two-six months), which made not just childbearing but everyday life conditions impossible. Though the sample did not include male PhD students, the gender-based contractual segregation (Knights – Richards 2003) of these female academics were also manifested in the interviews.

Low income was another source of uncertainty in the interviewees' lives in accordance with international literature on youths (Leathwood – Read 2020, Ivancheva 2019) and PhD students (Aitchison – Mowbray 2013, Haynes et al. 2012, Mason 2009). Low income influenced women's WLB in different negative ways. Apart from motivation and gaining professional experiences, these PhD students undertook work in parallel with their studies because – not surprisingly in the public sector in Hungary –, neither PhD fellowship stipends, nor their lowest-ranked academic staff salaries were sufficient to become financially independent. This is why male engineers tended to find positions in the private sector, hence they are still considered as the main breadwinner in the family. Though salaries are regulated in public research institutes, the present research explored gender-based practices that (further) contribute to the pay-gap in the Hungarian R&D sector (See Figures).

Though it was not the focus of the present research, it ded reaffirm that income has a vital effect on childbearing, as it is introduced by a wide scale of research both in sociology and demography (Mason et al. 2013, Spéder – Kapitány 2014, Bernardi et al. 2008). Low income increased housing problems, for these students, which definitely had a delaying effect on their motherhood – particularly for those born in rural cities who had had to settle in the capital without family support nearby. Moreover, at the time of the interviews, higher educated

students were not eligible for parental leave (as in the majority of the developed countries), which also undermined their financial stability to establish a family. It can be a focus of interest in future research to examine the effects of the introduction of GYED Extra in 2014 in Hungary, which aimed to resolve this obstacle.

Women, particularly mothers (all CEBE students), also faced blunt gender- and parenthood-based discrimination in the labour market, also described by previous studies (Benson et al. 2017, Hayes – Biglerb 2013, Maxmen 2018, Settles et al. 2013). CEBE students perceived quite supportive attitudes on the part of the management towards motherhood in the public sector, but this positive attitude even vanished when women became mothers (Springer et al. 2009). They faced discrimination regarding the length of their contracts, income, reintegration after childbirth or job applications. Non-mother PhD students also experienced that the social status of mothers were devalued because it was associated with lower ability and lesser general competence in their profession (Manchester et al. 2013, Ridgeway – Correll 2004, Moss-Racusin et al. 2012). These experiences generated omnipresent insecurity and stress that permeated their lives. At the same time, EIE students encountered a plethora of gender-based discriminative practices and also attitudes that sent a clear message that motherhood and career are hardly compatible in engineering. This is perhaps why I could not find mothers in this field for the interviews. Being a mother was inconsistent with the ideal worker type in their highly male-dominated fields that scarcely supported women's WLB (Rosa 2021, Acker 2006).

The fear of negative attitudes towards mothers and their discrimination can be better understood if we take into consideration the prevailing traditional gender and family roles in Hungary, including the long tradition of the long, three-year parental leave. There is a strong social agreement in society that mothers should stay at home up to the age of three of their child (Makay 2018, Blaskó 2011), and these norms were clearly identifiable among the interviewees. Though these women seemed to be free to decide on the length of maternity leave, they were often afraid of breaking this very high normative expectation. However, women were also aware of the fact that taking a three-year break in their highly knowledge-intensive profession would face them with severe motherhood penalties in their careers (Staff – Mortimer 2012, Budig – England 2001, Correll et al. 2007).

The unequal share of household and caring tasks also challenged the WLB of these female PhD students. While childless interviewees with partners were likely to share household chores quite equally with their partners, young mother engineers seemed to take the "second shift" almost alone in this research as well – a global phenomenon that has hardly changed during the decades

(Szalma et al. 2020, Schiebinger – Gilmartin 2010, Hochschild 1989). Though they sometimes underlined that their partners were caring fathers as described by Takács (2019), but deeper inquiry revealed that they featured rather traditional share of household chores and also the very traditional primary caregiver role. Though mothers in this sample experienced heavy work-family conflicts, they did not want to confront these traditional caregiver roles, either (Makay 2018, Blaskó 2011). They had reservations about childcare institutions and babysitters, and they tended to seek support instead from their parents or siblings.

In contrast with European cross-country research on women in engineering (Godfroy-Genin 2009), female engineers in this research perceived that they would have to make a choice between family and career. Women in Godfroy-Genin's research (2009) were at later stages at their career, namely, they did not leak out from the academic pipeline, and this experience may allow the assumption for them that a career and motherhood in engineering is somehow reconcilable. Nevertheless, they also noted that in a dual career one career is always behind the other. It is worth considering to what extent these female PhD students in Hungary are prone to slow career advancement or liable to abandon science if they found work and family irreconcilable at the threshold of their academic career – even before obtaining the degree (Xie et al. 2015, Mason et al. 2013).

Finally, results again confirmed that WLB is also considered as a woman's private issue and problem (Moen 2011). Though some literature described how PhD students seek support within the organisations (Cockrell – Shelley 2011), neither previous Hungarian findings (Tardos - Paksi 2020), nor the present findings support those results. In the present research, women were likely to seek emotional and professional support from their partners (as Cech and Blair-Loy described [2019]) – if in fact they had one. Partner homogamy mitigated work-to-family conflicts and stress – as Byers et al. (2014) and Martinez et al. (2013) highlighted in the case of female doctoral students. Present results widened our knowledge how occupational homogamy (having an engineer partner) beyond educational homogamy has an essential role in WLB. Partners were not just "safe harbours" who eased work-family conflicts of women by discuss their working days and problems at home, but partners often provided professional support for their work in forms of professional arguments, proof-reading etc. – and vice versa. Meanwhile, the lack of such understanding partners often led to the end of these women's stable relationships, which also heavily contributed women's failure in realising their fertility plans. The lack of partner was an overall problem for the interviewee regarding their family plans – a factor that has been highlighted by Hungarian scholars (Szalma – Takács 2018, Spéder –

Kapitány 2014). While Nagy (2016) revealed the vital importance of strong partner support in the case of managerial women, my results draw attention to its importance at the beginning of an academic career. However, it is worth considering, if partner support is so vital for a successful career, how single women can progress in their academic career, particularly if they are mothers.

8.2   RQ2: Studying and working in engineering

In the present research, two unique features of the engineering profession were revealed that further constrained women's WLB: laboratory work and the negative attitudes towards women stemming from their male-dominated environments.

The role of laboratory work in WLB is scarcely mentioned in STEM-related studies. The long hours PhD students in the present research spent in laboratories seriously hurt their WLB, as Husu and Koskinen (2010) and Gardner (2007) mentioned in their research. The issue was particularly relevant for CEBE students, who worked with hazardous substances, therefore, laboratory usage appeared more inflexible and rigid for them than for EIE students in terms of time, place, and safety regulations. Adequate scheduling of laboratory work would have facilitated PhD students' WLB to some extent, but organisations shifted the responsibility to the individuals themselves. They sought some support from their group-mates and more often from their engineer partner for their laboratory work but did not have enough capabilities to effect change. They perceived the role of ICTs in laboratory work as positive, as it was discussed above, however, it cemented their non-stop availability for the organisations.

Regarding the role of the health hazards of laboratory work in the WLB of researchers, it has been, to my best knowledge, an entirely unexplored issue (albeit mentioned in Godfroy-Genin's work, 2009). In Hungary, laboratory work is (should be) prohibited during pregnancy, therefore careers of female researchers who work with hazardous substances are more gendered. Laboratory work significantly curbs the options for women, who also should take it into consideration regarding conceiving and breastfeeding periods. CEBE PhD students had to very thoroughly plan both their PhD research and their work when they planned to give birth to a child. Accidents could always happen in laboratories (Perrow 1984) even before becoming aware of a pregnancy, and women were also exposed to cumulative effects of these substances that can later manifest themselves in gynaecological, and therefore conception-related health problems. There were indeed such cases and experiences reported in my research.

The fact that laboratory regulations that restricted access to expectant mothers were not always kept neither by students nor by the institutions allows the assumption that they did not recognise or ignored the (often cumulative) health risk these substances implied. Failing to recognise and/or dismissing such risks tends to occur in the case of invisible hazards, such as isotopes – a finding that supports the theory of risk society described by Beck (2003) or more recently by Mansouri – Sefidgarbaei (2021). The question is whether it is really the disregard or underestimation of the health risks in their laboratory work that drove these female PhD students to break the rules, or instead the urge to meet the high demands of greedy institutions (Coser 1974) to obtain their degree in the shortest possible time. It brings us back to the issue of responsibility that again was shifted to individuals. Taking into consideration that men PhD students can also be exposed to certain risks, I see the issue as an urgent key intervention for stakeholders.

While CEBE students in their more gender-balanced fields reported mainly gender-based, labour market and motherhood-related discrimination as I discussed above, electrical and informatics engineers, without exception, reported a large number of negative experiences (sexism, negative stereotypes and discrimination, biased evaluation or unfair treatment) unambiguously referring to the presence of the chilly climate in their highly masculine profession, in which motherhood is even less likely to be supported (Maranto – Griffin 2011). This result shows that even engineering, where women's representation is the lowest (She Figures 2018), is not a homogenous field and it is worth examining different disciplines to gain a holistic picture on WLB-related problems in STEM fields. Women engineers in this research faced other challenges in their knowledge-intensive education and in their occupation as engineers. They had to balance their lives in a male-dominated environment, which, consciously or unconsciously, transmitted gender-based negative attitudes towards women regarding both their role as women and as "engineer women" (Gardner 2007, Bernstein – Russo 2007, Litzler et al. 2005).

Electrical and informatics engineers experienced a wide range of negative experiences that were rooted in the widespread masculine view of science, which is well described in the international literature (Xie et al. 2015, Blickenstaff 2005), but scarcely in the domestic one (Nagy 2014, Paksi 2014). Women's knowledge and professional performance were often devalued and belittled by male faculty and the majority of them felt that as a woman, they had to work more for professional acknowledgement than their male counterparts. This also explains the long working hours and their detrimental effects on their WLB and health. Although female PhD

students in the sample predominantly had strong researcher identities, the questioning of their competency could cast doubts on their career and family plans.

Women tended to suppress their femininity and tried to assimilate into the male-dominated environment (Kanter 1977). This coping strategy of ignoring biases (Hughes R. 2011) in order to be "one of the boys" definitely reinforces and reproduces gender inequality and discrimination both in education and on the labour market (Rhoton 2011). What is more problematic in the case of PhD students is that many of them already accepted this inequality, perhaps as a price for their PhD and acceptance as engineers. Women with a strong engineering identity are the most likely to persist in the profession (Ayre et al. 2013, Hughes G. 2011), therefore this dimension of the socialisation process in doctoral schools would be likely to be strengthened by stakeholders and individuals as well. Meanwhile, developing a strong professional identity for women is in conflict with non-career roles in their other life domains (partnership, childbearing, leisure time, etc), because they are seen as factors that distract women from their careers (Faulkner 2009, Halrynjo – Lyng 2009). A career that requires working continuously and being available as highly devoted individuals. Thus, women with a family orientation, violate the norms of ideal students and workers (Herman – Lewis 2012) as was discussed above.

The male environments of these women were also found to be rigid and insensitive towards gender and family issues, as was found by Ülkü-Steiner et al. (2000) and Cabay et al. (2018) among female engineer PhD students. Meanwhile, in the present research, some women concluded that the university they attended did not favour women at all. Based on the reports of these women it became clear that several biased male professors at the university systematically kept an eye on these women during their academic careers. Moreover, the wide-scale of negative stereotypes these women faced exposed them to the stereotype threat (Steele – Aronson 1995), which further depressed their professional achievement. Female PhD students in the present research also reported exclusion and isolation from the exchange of information, the old boys' club (De Welde – Laursen 2011).

These women had already encountered negative experiences during their undergraduate studies, which may have established some resiliency in their life courses (Máté 2021). Meanwhile, even being a faculty member could not protect them from the intrigues in doctoral schools, which also refers to their lack of capability to fight for gender equality. My results draw attention to women's WLB-related problems being magnified in STEM fields. Women face not just the "typical" negative, gender-based experiences in the labour market as women, but they are

furtherly negatively discriminated because they opted for a career in a "male" profession against all the stereotypes. Constraining factors described in thie present and in the previous chapters highly contribute to the leaky pipeline phenomenon, namely that women's advancement slows down or they disappear from science after obtaining their PhD degree (Xie et al. 2015). Most importantly, even a wider pool of engineer undergraduates will not solve the problem of the lack of highly skilled professionals in the labour market, if women tend to continue to abandon their careers at later career stages. In Hungary, where the proportion of women in Research and Development and in engineering has started to decrease even further, and where there is a low awareness of gender equality, it would be vitally important to raise awareness of this issue.

8.3   RQ3: Timing of childbearing

The case of female PhD students exemplifies general societal trends concerning the situation of women. Life phases spent in education are not only becoming longer but are also more important for women in general. For a growing segment of this population education time is further extended by some form of postgraduate study. The most significant dilemma for female PhD students related to the timing of their first child can be traced back to the tension between the defining social norms and the perceived feasibility of their family plans. In line with Huinink's (2013) argument I found that the transition to motherhood was often delayed among women PhD students in this research. It was concluded that in engineering, there is no such thing as an "ideal period" for having a first child if someone aims to obtain a PhD degree, therefore, the "least bad" option is to become a mother during dissertation writing. To finish postgraduate education was clearly a strong social expectation towards youth, and also a criterion set by the students. To establish a relatively secure career track and the necessary material conditions for family plans were also strong demands for them, even if the public perceptions differ in this regard in Hungary (Pongrácz – S. Molnár 2011).

These difficulties and the high uncertainty in the outcomes of decisions are in harmony with earlier findings of Castaño and Webster (2011), that young mothers' decisions are shaped more by social and normative pressures, rather than by their perceived best choices. Moreover, electrical and informatics engineers (all childless) in this research tended to postpone their childbearing even after obtaining their degree. They also planned fewer children than CEBE students and recount how intentional childlessness was a quite widespread pattern in their discipline. This result supports the phenomenon that though intentional childlessness is still a scarce phenomenon in Hungary, yet it is higher among higher educated women (Szalma – Takács 2018). Fertility-related decisions of these women were probably more influenced by

their male-dominated environment, and also by the presumably higher opportunity cost and motherhood penalty (Staff – Mortimer 2012, Manchester et al. 2013, Budig – England 2001).

Results showed that different, even contradictory processes of standardisation and de-standardisation occur in relation to highly educated women's life courses (Shanahan 2000, Huinink 2013). On the one hand, similarly to western countries, there is an apparent de-standardisation in the sequence of different life phases (education, work, childbearing) in Hungary. On the other hand, in the case of the investigated female PhD students a strong re-standardisation process can be observed in terms of career steps. It is an open question, however, if we can generalise results for similar life courses in STEM fields in CEE countries. Women already postpone their motherhood due to their undergraduate education, and the conflict between these opposing processes further postpones their childbearing. Moreover, the perceived risk of becoming "too old" for having children appears as a final limiting factor that must be taken into consideration when women try to harmonise their different life phases.

These three phenomena (standardisation, re-standardisation, and the perceived biological limit) – together with their respective orienting norms that are also in conflict with each other – create significant tension and paralysis by analysis (Schwartz 2004) in the lives of young female scientists and engineers. Results demonstrate that decisions in relation to one's life-course (starting, closing and "putting on hold" various life phases) are fraught with uncertainty (Blossfeld et al. 2005). This lingering uncertainty permeates the outcomes of PhD students' decisions in relation to harmonising family and career steps. It explains why they could not really find good (or good enough) decisions for the timing of motherhood and its effect on their career. Moreover, these uncertainties could be witnessed in the case of labour market decisions, such as finding a position and returning after childbirth. Again, career progress (see the re-standardisation argument above) with its clear and unambiguous steps was seen as a relatively stable point of reference compared to other areas of life.

Women were highly aware of their own situation and tried to find solutions to the conundrums they faced. However, solutions identified by female PhD students were highly individualised and they do not reflect the fact that their conditions might be the result of collective life situations needing collective answers either at the micro (sharing labour market uncertainties of having children with their partners) or the macro (changing childcare assistance provisions) level. Historically, it could be argued that coordinating transitions between life courses in the state-socialist era might have been easier as it was a heavily standardised and institutionalised

"state assisted" matter. However, when this type of paternalism ebbed away, new tensions appeared due to de-standardisation.

Though Hungarian youths also tend to postpone their motherhood, as it is described by scholars (Lesthaeghe, 2010), we found that the conflict of the academic and the biological clock of women and a high level of work-family imbalance also seems to strengthen and further expand the extant attitudes favouring postponement of higher educated women. At a certain age, starting one's career cannot wait, whereas family foundation becomes less age-related (Huinink, 2013). Meanwhile, women's choices were constrained (Castaño – Webster 2011, Hobson 2011), as they were forced to choose the "least bad options", which also led to postponement but with high-level tension and stress in their lives. Meanwhile, these women reject the idea of late childbirth or total childlessness. Moreover, they insist on the very traditional notion of parenthood; thus, they will bear the sole responsibility for caring for their future child. This well reflects on the prevailing traditional family roles in Hungary (Gregor 2016). Furthermore, it can be said that the concept of motherhood resists value changes or de-institutionalisation in Hungary (Kohli 2007). Thus, paradoxically, the strength and obduracy of this norm make the decisions on childbirth more difficult for Hungarian women, and in turn, contribute to the low fertility rate.

8.4   Conclusion

Based on the discussion above, four main conclusions can be drawn. Firstly, both academic and individual life courses of female PhD-students in the present research were highly gendered even as early as PhD education. Their main WLB-related dilemmas, including the timing of childbearing stemmed from the irreconcilably overlapping milestones of their academic and individual life courses, a phenomenon that less likely affects men. Women PhD students' engagement in multiple roles – education, work, private or family life – were influenced by normative, institutional, and structural context that led to a high level of work-life and work-family life imbalance. The reconciliation of the different life spheres occurred under high-level labour market and workplace uncertainties that – along with the aimed/expected goal to undertake the majority of childcare and household tasks at home – marked different life courses for women than men. Gendered social pressure regarding parental leave norms sent different messages towards them; their male-dominated profession required a short, while the wider society expected the traditional long parental leave period that made the reconciliation of work and motherhood particularly challenging. Even flexible working arrangements traditionalised

these students' gender roles and responsibilities even in the quite gender-balanced field of chemical, environmental and bioengineering.

As a result, a typical career pattern of female and male life courses outlined in the research; women opt for positions in the public sector that was perceived more family friendly than employment in the private sector, meanwhile men rather pursued careers in the better paid private sector in order to be able to take care of the family. Women in this research already accepted, therefore reproduced this gendered life course pattern, for they felt they have to choose between career and family. It is a question whether their resiliency they might developed during their early career would be able to retain them in science. It is also a paradoxical and even tragical situation that while these women postpone their motherhood due to their careers – plus confront their internalised social norms, risk their own and their babies' health as well as their fertility plans, and also bear the stigmatisation of careerist women –, that, after becoming mothers, not having other options, they tend to give up that selfsame career.

It is another conclusion that life courses of these female PhD-students in engineering are more gendered due to their further intersection with the unique barriers of the male-dominated STEM fields. Women's exclusion and isolation in STEM fields had adverse effects on their research productivity, which further weakened their capability to strive for a better balance both in doctoral schools and in the labour market. Electrical and informatics engineers, moreover, tended to disregard – or did not recognise – prejudice and biased practices in their male environment, which does not challenge the dominant culture of universities and companies in STEM fields. in the field of engineering and the environment was particularly chilly for electrical and informatics engineers. The essential role of women had already clashed with the role of working women, but they met further and different stereotypes in their male-dominated environment regarding their roles and knowledge. WLB of these women were more challenging in the very chilly environments electrical and informatics engineers experienced. Though most of them socialised in families with long traditions in engineering, and they could have developed a certain level of resiliency during their academic career, these factors did not prevent the difficulties that continued in PhD education or even in employment. Laboratory work with hazardous substances is also gendered, for it curbs the timing of childbearing for women and also because of the health risks it implies.

The last conclusion is that these female PhD students were left alone with their dilemmas and in their struggle for WLB and career advancement. PhD students did not receive systemic support from their organisations, moreover, institutions tended to shift almost all responsibility

to them even in the case of the usage of laboratory work during pregnancy. Women engineers also could not seek support from senior women, for there is a lack of female role models in the profession. Though they developed different coping strategies in order to enhance the reconciliation of their work and life, these strategies were not well-developed or formalised coping strategies, and they also stretched women's mental and physical limits. If female PhD students socialise in a way that their struggle for WLB is their own choice and responsibility, it is not surprising that they do not seek organisational support.

In sum, if barriers introduced above are not eliminated, it would strengthen and reproduce the already gendered life courses in STEM fields. Women's negative experiences as early as PhD education will also contribute to women's slow career advancement or their abandonment of science. It is also worth considering that in Hungary, women's lowest proportion and their negative experiences occur in that field of science (engineering), which employs both women and men in the highest numbers within R&D. Namely, the majority of women researchers work in highly gender unequal environments. This inequality is likely to continue to alienate women from pursuing an engineering career, particularly in the private sector, where their proportion is already at its lowest.

8.5   *Academic and policy contributions*

Present findings can contribute to different academic discourses both in the international and the Hungarian contexts: firstly, to *work-life balance research*, because it targets the WLB of top-educated professionals with an explorative qualitative method and the gender perspective; secondly, to *life course approach*, because it applies qualitative method at mezzo and micro levels with the aim to find answers for the "why". Thirdly, to *women in science research*, because it examines a single STEM discipline, where the proportion of women is the lowest; highlights gender- and occupational-based differences even within the discipline; and also targets health risk as a barrier to WLB. It is also quite a novelty that the negative effects of male-dominated environment are linked to work-life balance issues. In addition, the research findings would also chime with topical issues, such as risk society, and the *casualisation of academic work* and the *future of the university*.

Regarding the social relevance of my research, achieving a more balanced participation of women in science is more than an issue of mere social justice. Meanwhile, retaining top-educated, talented women in STEM occupations and avoiding significant losses in human, cultural, social and economic capital is a common social goal – especially in our new era of

knowledge-based societies, where the increasing lack of professional labour force can partly be overcome with women's increased participation. Increasing the proportion of women in STEM fields also would allow equal opportunities for professional success and enhance the overall well-being of working women. These goals are all in harmony with prime strategies and intervention points of the EU and other western governments. Eliminating the barriers also can help women to realise their fertility plan, which is another focal point of ageing societies in Europe.

The present research also identified intervention points for stakeholders. Though some of the phenomena discussed above are relevant in other stages of education or academic career, they should be handled with more attention in the case of PhD education. It is at the threshold of an academic research career and socialisation in doctoral schools determines attrition rates and also PhD students' future capabilities and choices. For universities it is worthwhile to considering creating a more supportive environment for students particularly in male-dominated disciplines or departments, which would facilitate the WLB of women (and also men's) and decrease attrition rates. There is a need at least for a) to decrease students' non-PhD-related tasks; b) to offer a calculable early-stage career in forms of more extended or permanent contracts; c) to foster gender-awareness and equality in the organisations by at least having a carefully developed and implemented gender equality plan with particular attention to family issues and discrimination; d) to have up-to-date and widely published regulations regarding laboratory work – particularly discussing health-related issues that are to be followed consistently.

8.6   Limitation and future research

It is a limitation of the research that though it included enough cases of young mothers in chemical, environment and bioengineering, results cannot shed light on the personal motherhood experiences of electrical and informatics engineers. Meanwhile, the difficult access to (or the lack of) PhD student mothers in this highly male-dominated field, as well as the results of the present research verify the need for a deeper inquiry into their WLB, perhaps at later stages at their careers. In my next research I will aim at exploring the work-life balance, persistence and career strategies of young female researchers in fields where their representation is extremely low, and also in different sectors of employment. Another limitation is that the decision on the timing of childbearing is a very complex research area and this

investigation focused on a narrow segment of it, based on individual perceptions. In the future, surveys on PhD students, as well as on doctorate holders would fruitfully contribute to the issue. It would be also worth examining more deeply the WLB of both genders during PhD education by applying recent more complex theories, such as the agency and capabilities approach (Hobson et al. 2011), that encompass institutional, individual and societal factors.

Finally, the findings of this present qualitative research with small sample size cannot be widely generalised, particularly not on the macro-societal level. However, the explorative qualitative research design did allow the collection of a wide range of information on young female engineers, and the sample is eligible to describe the main patterns, which all lead to deeper knowledge of this under-researched area. Results can help to highlight and understand dilemmas and strategies of not just female PhD students but of young female professionals in general, particularly those studying and working in male-dominated environments and/or laboratories.

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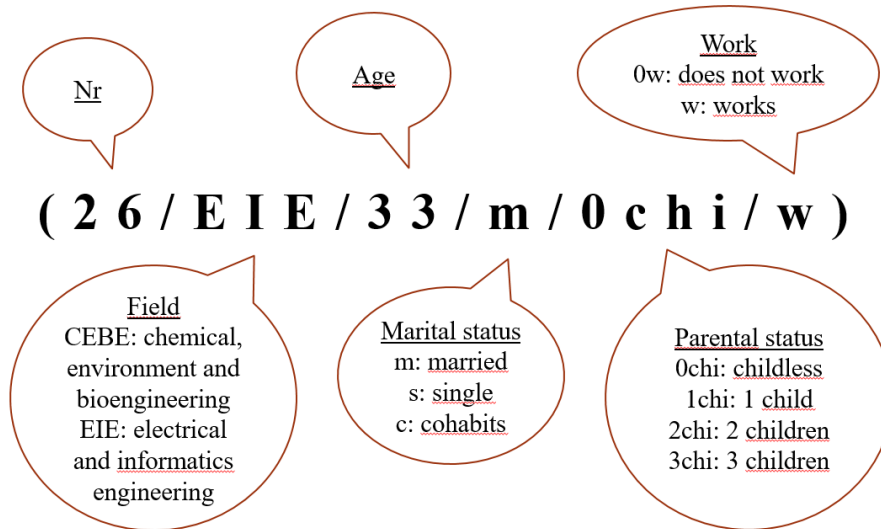
APPENDIX

Socio-economic background of the research participants

Nr	Field*	Age	Marital status	Child-ren	PhD financed	Work-place			Lab-work
						Yes / No	**Sector**	**Type**	
1	Ch	24	Single	0	State	No	–	–	Yes
2	Ch	28	Married	1	State	Yes. Maternity leave**	Private	Research institute	Yes
3	Ch	31	Cohabits	1	State	Yes	Public	Academia	Yes
4	Ch	28	Cohabits	Preg-nant	State	Yes	Public	Academia	Yes
5	Ch	28	Single	0		Yes	Public	Academia	Yes
6	Ch	26	Cohabits	0	State	No	–	–	Yes
7	Ch	31	Single	0	State	Yes	Public	Research institute	Yes
8	Ch	25	Cohabits	0	Pharmaceutical company	No	–	–	No
9	Ch	28	Married	0	State	Yes	Public	Academia	Yes
10	EB	28	Cohabits	0	Pharmaceutical company	Yes	Public	University	No
11	Ch	29	Married	0	Workplace	Yes	Private	Pharmaceutical company	Yes
12	EB	30	Married	1	State	Yes. Maternity leave**	Both	University	No
						Yes		Own business	No
13	EB	33	Married	3	State	Yes. Maternity leave	Public	University	Yes
14	EB	29	Married	Preg-nant	State	Yes. Sickleave**	Private	University in Western E.	Yes
15	EB	31	Married	2	State	Yes	Private	Pharmaceutical company	Yes

* Ch: chemical engineer; EB: environment and bioengineer
**Employment contract terminated

Second subsample: Electronic, electrical and informatics engineers (EIE)									
Nr	Field*	Age	Marital status	Child-ren	PhD financed by	Work-place			Lab-work
						Yes / No	Sector	Type	
16	IE	26	Cohabits	0	State	Yes	Public	Academia	No
17	EE	28	Married	0	State	Yes	Both	Big enterprise	No
						Yes, part-time		University	Yes
18	IE	26	Cohabits	0	State	Yes	Public	University	Yes
19	IE	27	Single	0	State	Yes	Both	University	Yes
								Own company	
20	IE	33	Cohabits	0	Student	Yes	Both	University (full)	Yes
								NGO, part-time	
21	IE	26	Single	0	State	Yes	Public	University	No
22	EE	32	Married	0	State	Yes	Public	University	Yes
23	IE	27	Single	0	State	Yes	Public	Research institute	Yes
24	EE	25	Married	0	Student	Yes	Public	University	Yes
25	EE	30	Single	0	Workplace	Yes	Public	University	Yes
26	EE	33	Married	0	Student	Yes	Public	University	Yes
27	IE	27	Cohabits	0	Student	Yes, part time	Private	Research institute	No
*EE: electrical engineer; IE: informatics engineer (computer scientist)									

Abbreviations in brackets at the end of the interview quotations (in chapter 7 on results)

Nr

Age

Work
0w: does not work
w: works

(2 6 / E I E / 3 3 / m / 0 c h i / w)

Field
CEBE: chemical, environment and bioengineering
EIE: electrical and informatics engineering

Marital status
m: married
s: single
c: cohabits

Parental status
0chi: childless
1chi: 1 child
2chi: 2 children
3chi: 3 children

WLB: work-life balance
WFB: work-family balance
WFC: work-family conflict
LC: life course
CEBE: chemical, environment and bioengineering
EIE: electrical and informatics engineering
STEM: science, technology, engineering, and mathematics
SSH: social sciences and humanities
R&D: Research and Development

Interview guide

1. How and why diid you become an engineer?
2. Why did you decide to embark on/complete a PhD?
3. Have there been circumstances or individuals that have helped and supported you so far on your *professional* journey, which have definitely advanced your career?
   Have there been circumstances or individuals that have rather hindered you so far on your *professional* journey, which have definitely harmed your career?
4. How important is a PhD in your profession and when is it recommended to start? Why?
5. What is your PhD topic, what tasks come with that and what makes up your average day?
6. Can you take your work home, and, if so, do you?
7. What does Work Family Balance mean to you?
8. How much do you feel that your studies/work and family life are in balance? (Are you satisfied with this, would you like to change anything?)
   - How much time can you spend on your family life and how much on your studies (work)?
   - Do home or work circumstances and events affect the other area?
   - To what extent can you separate these areas?
9. How do you balance these fields in every-day life?
10. In the technical field or in your profession, to what extent can a balance between work and family life be achieved by a woman? And in your view, to what extent can a man achieve this?
11. When you chose this profession/job, did you think about how you would balance your work (study)

and family life?

12. At your age, in your professional circumstances, during university and doctoral training, how much is it usually possible to form a lasting relationship? What is your own experience?

13. In the technical field or in your profession, when is it ideal for a woman to have a child if she also wants a PhD? One before the other or both together? (Age?) Why? And when is it ideal for a man?

14. What are the pros and cons of having a child during doctoral training in your profession? And for a man?

15. And if a woman starts her PhD not immediately after university, but a few years later? What is the best strategy? And for a man?

16. In your opinion, are there any specifics in the technical field or in your profession that affect the timing of having children and balancing work and family life? *(if none are mentioned, then ask)*
   - Laboratory (schedule, health reasons)
   - Experiment
   - Teamwork

17. Is there a difference in the timing of having children in your profession or technical field, or in the balance between work and family, depending on whether someone works in the public or private spheres? If so, what and why? *(if none are mentioned, then ask about these)*
   - worktime flexibility (overtime, deadlines)
   - laboratory regulations

18. In which sphere would you rather work? Why?

19. How typical are foreign studs and working abroad during a PhD in your profession? How do they affect the balance of family life?

20. In the following I would like to ask about having a child in more detail

no child Would you like to have a child? If not, why not? If so:	*has a child*
How do you PLAN to have children?	So you have ... child(ren), and you were ... years old when the first one was born.

a) How many children would you like up to what age approximately?
b) Why are you planning that number and what conditions must be in place for you for having a child?
 	
c) Did starting your PhD have an effect on when you would like to have a child?
d) What were your strategies for balancing PhD, work and childbearing?
  • How are tasks at home allotted? (partber, relatives, paid help, other)
  • When did you start working? How did you deal with your professional work?
 	
e) What would help you to reconcile your PhD/work and having a child?
f) And what would hold you back?
g) How does your workplace/Doctoral school (director, supervisor, teachers, fellow students) relate to a student
	a) Altogether how many children would you like? .... If planning more: At what age approximately?
	b) How did your first childbearing COME ABOUT? To what extent was it planned and what conditions must be in place for you for having a child?
	If there is a second child, then ask about that, too, and also about any future planned children [timing and reason])
	c) Did starting your PhD have an effect on when you wanted to have your child?
	d) What were your strategies for balancing PhD, work and childbearing?
	  • How are tasks at home allotted? (partber, relatives, paid help, other)
	  • When did you start working? How did you deal with your professional work?
	(if there is a second child then ask about that, too, and any further planned children
	e) What helps or would help you to reconcile your PhD/work and having a

having a child? h) As you see it, how do your fellow students who have children balance their professional and family lives? i) How will having a child affect your career?	child? f) And what holds you back? g) How does your workplace/Doctoral school (boss, supervisor, teachers, fellow students) relate to a student having a child? h) As you see it, how do your fellow students who have children balance their professional and family lives? i) How did having a child affect your career?

21. Is that how you planned your childbearing and your career in the past? (timing, coordination of work and family tasks). If not: what has changed?

22. Do or did your family, workplace or friends know about your plans to have children? If so: what is (was) their opinion about it?

- If you don't want a child: "... do they know you don't want a child?"
- If the child was unplanned:: (the question need not be asked)

23. Is there anything else about the balance between studying, working and having children that we have not talked about, but that you consider important?

→ Could you perhaps recommend a fellow student with whom I could conduct an interview?

→ Or perhaps a fellow student about whom you know that they will not finish their PhD, probably for family reasons?

→ If a question has been left out or if I would like to ask about something else, may I contact you via email?

→ Is there anything you consider important or that you would like to say about anything I have not asked about?

→ Will you allow me, a couple of years from now, to contact you again and speak about everything again? For this it would be important for you to let me know if your contact details change.

→ Thank you for the interview!