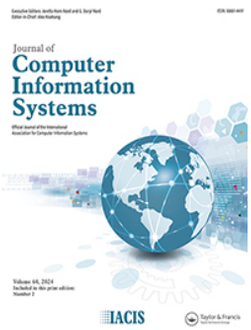

Journal of Computer Information Systems

ISSN: (Print) (Online) Journal homepage: www.tandfonline.com/journals/ucis20

Women in IT: A Work Ecosystem Perspective

Alexei Tretiakov, Tanya Jurado & Jo Bensemann

To cite this article: Alexei Tretiakov, Tanya Jurado & Jo Bensemann (01 May 2024): Women in IT: A Work Ecosystem Perspective, Journal of Computer Information Systems, DOI: 10.1080/08874417.2024.2346766

To link to this article: https://doi.org/10.1080/08874417.2024.2346766

Published online: 01 May 2024.

JOURNAL OF COMPUTER INFORMATION SYSTEMS
https://doi.org/10.1080/08874417.2024.2346766

Taylor & Francis
Taylor & Francis Group

Women in IT: A Work Ecosystem Perspective

Alexei Tretiakov, Tanya Jurado, and Jo Bensemann

Massey University, Palmerston North, New Zealand

ABSTRACT

The literature devoted to gender imbalance in the IT industry tends to focus on women's experiences within organizations. We extend the flexible careers model to account for the role of an IT work ecosystem formed by interconnected organizations and individuals involved in shaping and supporting IT work. Based on a thematic analysis of 46 interviews of women employed in IT roles in New Zealand, we demonstrate that their experiences in negotiating gender discrimination and work-life balance issues are best understood in terms of their interactions with the IT work ecosystem, rather than solely in terms of interactions within individual organizations. The participants identified themselves with the ecosystem and perceived their careers as progressing within the ecosystem. Their experiences were often gendered, but gender dynamics could play to their advantage, such as in steering them toward managerial or sales roles associated with greater power and autonomy than technical roles.

KEYWORDS

Women in IT; work ecosystem; flexible career

Introduction

The considerable body of literature devoted to gender imbalance in the IT industry and to women's experiences in the IT industry[1–13] recently reviewed by Gorbacheva, Beekhuyzen, vom Brocke and Becker,[4] mainly adopts an organization (e.g., Venkatesh, Windeler, Bartol and Williamson[1] or whole IT sector perspective (e.g., Richterich.[14]

The IT sector is implicitly seen as a collection of organizations with certain characteristics, rather than as a collectivity exercising agency. However, as IT professionals tend to change their organizational affiliation fairly often (with a typical tenure of three to five years,[15] driven by factors such as the desire to maintain a growing and up-to-date skill set, a career of an IT professional often unfolds across organizations, rather than within a single organization. Indeed, becoming an independent consultant working, in sequence, for multiple organizations and commanding higher-than-average income is often seen in the IT industry as a paradigm of success.[16] At the same time, because careers are driven by social networks[17] shaped by geographical, cognitive, institutional, and social proximity,[18] an IT professional's career is bound to unfold mainly within a work,[19] industry,[20] or professional network[21] ecosystem that is smaller than the whole global IT industry, but larger than a single organization.

Subramony, Solnet, Groth, Yagil, Hartley, Kim and Golubovskaya[19] defined work ecosystems as "emergent sets of dynamic formal and informal work arrangements involving human and non-human actors, interacting as complex interconnected systems" (p. 957). Similarly, Litchfield, Hirst and van Knippenberg[21] defined a professional network as "the core communalities across transient relationships" (p. 2021). Thus, the issue of a woman becoming an IT professional can be formulated as the issue of her joining an IT work ecosystem. The barrier to be overcome is joining the ecosystem. Once she joins the ecosystem, movement within the ecosystem is facilitated by the dynamics of the ecosystem, characterized by "creation of value through sustained relationships"[19] (p. 958) transcending organizational boundaries. Further, the issue of her thriving as an IT professional is the issue of her success in an IT work ecosystem, rather than within a particular organization. How a woman experiences her IT career, including aspects like work-life integration, the ability to combine work with other life roles, such as child-rearing,[22] is ultimately determined by her interactions with the ecosystem, rather than merely with a particular organization, as the ecosystem offers a considerably broader range of possibilities for job crafting[12] than a single organization.

Correspondingly, the purpose of the present study is to achieve a better understanding of the role of the IT

CONTACT Alexei Tretiakov A.Tretiakov@massey.ac.nz School of Management, Massey University, Private Bag 11 222, Palmerston North 4442, New Zealand

work ecosystem in shaping the careers of women in IT, addressing the following research question: How does the IT work ecosystem contribute to women's success in IT careers?

Theoretical foundations

Conceptualizations of a career as movement across organizations (possibly, with occasional breaks for childbirth or other reasons) are well developed in the human resource management literature,[23] but less so in the Management Information Systems literature or within the research discourse around achieving gender balance in IT. The boundaryless career concept[24,25] emphasizes inter-organizational mobility. Specifically, both employees and employers understand that their relationship is temporary, and employees seek opportunities for growth, such as, in IT context, exposure to new technology, through mobility. Concurrently, employers create an environment that supports employee mobility while extracting maximum value over the period the employee stays with the organization. From the employer's perspective, employees intending to leave eventually are motivated to achieve, as achievements enable mobility.

A related concept is the protean career,[26,27] which emphasizes the subjective definition of career success, with employees crafting their careers within and across organizations to satisfy their values, which might shift over the course of their professional lives (for example, from achieving legitimacy in a profession by participating in successful projects to work-life balance).

A concept highly related to the protean career, but focusing on women, is the kaleidoscope career.[28,29] In a kaleidoscope career, periods off work, such as for maternity leave, are part of a woman's career. So, women reject linear upward career progression, instead shaping for themselves careers that accommodate the changing foci in their lives (such as from professional attainment to family and back) and the needs of important others, such as children or aging relatives.

Finally, the concept of a flexible career[30] emphasizes support provided by the institutional environment through education and training, welfare, working-time and leave regulations, and retirement systems. The institutional environment provides continuity and support as individuals move across organizations and experience periods off-work in their career journey.

Interconnected organizations and individuals involved in shaping and supporting work in a particular domain, such as IT work in New Zealand, form a work ecosystem. Conceptualizations of a woman's IT career as movement across organizations fit well with the concept of an IT work ecosystem, as an IT work ecosystem may enable boundaryless, protean, or kaleidoscope careers. For workers who frequently change employers, the effect of institutional factors on their overall experience is likely to be magnified, because they are less shielded from the institutional environment by the management structures and culture of a particular organization.[19] The same may be argued for the work ecosystem: workers routinely moving across organizations are exposed to the work ecosystem more directly. The flexible careers model takes into account the effects of institutional factors. However, the role of the work ecosystem has been insufficiently taken into account in the existing conceptualizations.

The literature devoted to women in IT is strongly influenced by the career model by Ahuja[31] and by the associated metaphor of a "leaky pipeline."[4] The model of career progression for women in IT by Ahuja[31] suggests a sequence of three stages: choice, persistence, and advancement. Choice refers to choosing to enter the IT profession in the first place and is a stage beyond the scope of the present study. Persistence refers to persisting in the IT career in the face of challenges related to starting and raising a family. Advancement refers to later years in which raising a family presents less of a challenge (as children grow up) and salary and status become more important. Thus, Ahuja's model, in its basic configuration, does emphasize career progression (even conceptualizing careers as "paths to power" (p. 22)) and does not allow for a variety of priorities, unlike the kaleidoscope career concept.

Ahuja's[31] model is very specific in suggesting barriers that women face in pursuing IT careers. Work-family conflict, male-dominated occupational culture, and lack of female role models are suggested as barriers that affect the persistence stage. Further, male-dominated and unwelcoming to women informal networks, lack of female mentors, and institutional structures (such as lack of flexible hours arrangements) are suggested as barriers that affect the career advancement stage. Armstrong, Riemenschneider and Giddens[2] validated the overall structure of Ahuja's model and suggested minor modifications, most notably, that advancement is also affected by work-family conflict and social expectations.

Ahuja's[31] model focuses on barriers that women face, and thus is one-sided in describing women's experience in IT. In contrast, the flexible career concept developed by Tomlinson, Baird, Berg and Cooper[30] accounts for career support at organization and, in particular, institution levels, although, unlike Ahuja's model, it does not target women in the IT industry. The importance of focusing on support factors, rather than just barriers,

has been highlighted by Annabi and Lebovitz,[3] who studied gender diversity interventions in the IT industry. We follow Annabi and Lebovitz[3] in arguing that both to understand women's experience in IT and to make suggestions to advance women's careers in IT, one has to account for both barriers and factors promoting success, because focusing on success broadens the space of possibilities. We argue that a narrow focus on barriers limits the scope of possible interventions or career strategies. Moreover, excessive emphasis on barriers in public discourse may, in fact, be achieving the opposite of its intended goal and may discourage women from entering IT by hurting their self-efficacy.

Materials and methods

A qualitative interview-based design was used, as is suitable for an exploratory study.[32] Interview data offered insights into both women's experiences and their perceptions of these experiences.

A call for participation was issued via a LinkedIn advertising campaign targeting New Zealand women working in IT. The guidelines established by the Massey University ethics committee were followed, resulting in filing low risk notification number 4,000,021,796. Participants provided consent after being informed about their rights before the start of each interview.

In total, 46 interviews were conducted over Zoom and digitally recorded with the participants' permission. The interview schedule focused on individuals and organizations that have helped the interviewees in their pursuit of IT careers and on how their careers and such support unfolded in time, with the main questions worded as follows: "How would you describe your educational background?," "How would you describe your family situation?," and "Which individuals and organizations have helped you in your search for information technology related jobs? How did they do it?," followed by questions covering demographic data. Although the overall pattern of questioning remained consistent across the interviews, following established practice in inductive qualitative research[33] the participants were encouraged to play an active role in the interview and to shift the discussion to related subjects that the they felt to be salient. The participants' characteristics are summarized in Table 1. A broad range of participants were interviewed, including organizational employees, contractors, and IT entrepreneurs, in both technical and non-technical roles, such as IT sales. The participants' LinkedIn profiles were also reviewed, offering an extra source of evidence.

Thematic analysis[34] of the interview transcripts was conducted. In Phase 1 of the analysis, we transcribed the digital recordings of the interviews and repeatedly reread the transcripts and listened to the digital recordings, taking notes to capture ideas to be explored in subsequent coding.

In Phase 2, we generated initial codes, approaching the data with the focus on actors and institutions facilitating women's career transitions and women's experiences in successive career roles, focusing in particular on gender-specific experiences. Following Braun and Clarke,[34] the analysis was, in part, "theory-driven," rather than "data-driven," as the analysis was influenced by a lens adopted a priori, rather than purely inductive.

In Phase 3 we organized the codes into themes and refined the themes to ensure internal homogeneity (internal coherence) and external heterogeneity (clear distinctions between themes). Finally, the insights obtained were presented in textual form.

Phases 1 and 2 were primarily conducted by the first and the second author, while all three authors were involved in Phase 3. Perspectives were aggregated via discussion. The perspectives of the authors were complementary, with the first author having a background in information technology and the remaining authors with research records in women and work studies. In integrating the perspectives, the emphasis was on combination and on mutual reinforcement, rather than on plain agreement.

Findings

The ecosystem

The participants reported receiving support from traditional educational establishments (e.g., universities, polytechnics), recruitment agencies, Internet resources facilitating employment (e.g., LinkedIn and Seek (https://www.seek.co.nz)), IT certification providers, IT boot camps bringing together job seekers and IT industry representatives, and informal technology meetups. However, the most important source of support was informal professional networks, with formal organizations often contributing by facilitating the initial connection to informal networks or by facilitating interactions in established informal networks:

> I get invited to companies where I have worked before - main source of job opportunities. . . one time - through an agency, still by someone for whom I have worked before. (Christine, IT project manager)

> I got an internship via a person I met at a meetup. (Sunita, discussing getting her first IT job)

Table 1. Research participants.

Pseudonym	Age	Number of children	Years in IT	Current role	Interview duration (min)
Alaxandra	30–39	2	7	Test analyst	14
Alison	40–49	0	18	CEO	8
Annette	30–39	2	12	Product manager	12
Beverley	30–39	2	13	Technical support manager	8
Catherine	30–39	0	10	Management consultant	17
Christine	50–59	2	30	Senior project manager	5
Colleen	40–49	2	10	IT sales	16
Deborah	50–59	2	20	Business analyst	8
Denise	18–29	0	3	Product designer	12
Dianne	50–59	1	19	Systems programmer	12
Elizabeth	50–59	3	18	Consultant	13
Gail	40–49	1	15	IT consultant	13
Gita	18–29	0	3	Python developer	7
Heather	40–49	1	20	Project manager	10
Helen	40–49	2	4	Business analyst	11
Janice	18–29	0	5	Software developer	10
Jennifer	40–49	2	10	IT sales	9
Jillian	50–59	2	20	SAP consultant	9
Judith	40–49	0	15	Software developer	10
Julie	40–49	0	20	Technical consultant	11
Lesley	30–39	0	19	Business analyst	9
Lynette	30–39	2	5	Channel sales manager	9
Margaret	50–59	1	36	Video conferencing infrastructure	12
Maria	30–39	1	15	Technology architect	9
Marilyn	50–59	0	21	Administration/word processing	12
Mary	50–59	1	22	Web design	12
Maureen	30–39	1	0.5	Technical writer	10
Mina	18–29	0	2	Full stack developer	12
Pamela	50–59	2	30	Project manager	11
Patricia	18–29	0	0.5	IT sales	5
Pauline	30–39	2	4	Sharepoint consultant	9
Raewyn	50–59	3	35	CEO	6
Rekha	40–49	2	17	BI technical lead	11
Robyn	18–29	0	1	Marketing automation analyst	6
Rosemary	30–39	0	6	IT sales	8
Ruth	40–49	0	10	Java developer	14
Sandra	40–49	1	16	QA analyst	12
Shanti	30–39	0	7	User experience designer	11
Sharon	18–29	0	3	Automating legal documents	10
Sheryl	18–29	0	5	Software engineer	8
Shirley	30–39	0	3	Software programmer	8
Sunita	18–29	0	4	QA lead	18
Sushila	30–39	0	10	Product design	7
Suzanne	30–39	0	12	Software developer	10
Wendy	18–29	0	4	Product designer	10
Yvonne	40–49	5	1	Data entry	7

> The best approach is to contact companies directly and show your passion for why you want to work for their company. (Suzanne)

There were many ways to participate in the ecosystem: as an employee of an IT company (part time or full time), as a consultant, or as an entrepreneur. The respondents could change the mode of their participation in the course of their careers, with the connection to the ecosystem remaining the only constant. The level and the definition of success varied, with some of the respondents achieving very high success. For example, Catherine, educated as an architect (eyeing a role in the construction industry), started as an IT project manager, became an "executive before the age of thirty," and she is now working as a consultant from one of the most coveted locations in NZ, commenting "now, it is about freedom and flexibility, lifestyle."

Even those who were considerably less professionally successful tended to be very positive about their involvement with IT. For example, Yvonne, a mother of five and a Māori (an Indigenous New Zealander), found an IT job after 10 years out of the workforce. Yvonne "really enjoyed the culture" in IT: "they specify exactly what they like you to do… give you ample amount of time to do it," and "they do allow leniency for unexpected situations that might occur."

At the same time, to establish an initial connection to the network, one often had to be proactive:

> Nobody is going to reach you, you are not a Bill Gates, it's you.… You have to be desperate… just approach people you do not know to be a messenger for you.…

> Some people do not reply, it's embarrassing, but it's OK... just go to that company and mail them directly. (Sunita)

However, once an individual was connected, the ecosystem could be proactive in maintaining the connectivity. For example, Alaxandra's company closed their office in Wellington and "we were all made redundant." However, she was immediately contacted by recruiters (who knew about the closure) via LinkedIn, which resulted in her getting her current job.

Most of the participants changed employers frequently, rarely staying with the same organization for more than five years, sometimes shifting between being employed by an organization, entrepreneurship, and contract work. Few identified strongly with their current employer. For example, Janice was the only one who referred to an organization that she does not lead as "my company." Raewyn was the only one who reported a career successful in a traditional sense, rising to the top within a single organization: "I worked my way up through engineering into management and now a director of the company."

Gail worked for a bank for about 10 years, starting as a teller and gradually shifting to IT, "ultimately the bank created a role of an Internet business manager for me." Next, Gail started her own company focusing on digital payment. Then, an international company invited her to take her current IT job.

The IT work ecosystem and the associated professional network have fuzzy boundaries, and many of the women shifted to IT jobs from other domains, almost incidentally:

> I started at NZ Herald [a major newspaper].... It was not just IT sales job, there were a lot of technical processes... a lot of analytics... more technical than initially anticipated.... I really enjoyed it. (Lynette, an IT channel sales manager)

> Lots of sales roles, now IT. (Patricia)

> Kind of fell into IT, from consumer electronics.... Opportunity kept me in IT, opportunity to learn and grow and develop, do new things. (Jennifer)

> All my formal qualifications are on construction side of things. (Catherine)

> Used to work in operations, moved to IT when returning from a maternity leave. (Pauline)

Colleen, educated as a psychologist, started in human resources, and found that "knowledge on how to recruit IT people is useful for selling software as a service." She shifted to IT sales while on a childcare leave:

> You are sitting at home, you are great on the phone, why not work for sales?... [I am] now managing all of the sales of this company in the whole of NZ. Sales - a good way to build a network.... I manage my own business, no-one telling me what to do.... It is not all about sitting in front of a computer, I am spending most of my time in front of customers. I am passionate about women in IT for the sake of my two daughters... to make it accessible... to make it an easier space for them to get into.

Family and friends were often instrumental in facilitating the first connection. Janice found her first IT job via a friend. Shanti found her first IT job via her partner: "he has connected me to a friend of his who has connected me to a friend of his." Once in, the connections can be updated by the ecosystem proactively: "for my most recent job I was approached by the director of the company I am working with. I was not looking for a job, but I was approached for a role" (Shanti). Maureen also relied on her partner: "my partner knew the person, it is a very small NZ start-up, and I knew another person who worked there as an IT engineer as well." Alaxandra, who recently emigrated to New Zealand, took a course on software testing from a university, but she found her first New Zealand job via her husband.

Most of the participants did have tertiary education, although often not majoring in IT (general business degrees were the most common). However, none of the participants described their university study as a source of inspiration or of unique knowledge. In comparison, IT boot camps that offered direct opportunities to connect with the IT work ecosystem, were explicitly highlighted as highly valuable: "got a few interviews and a job out of that [boot camp].... Got offered an ongoing role after a 3-month internship" (Wendy). Many of the participants were engaged in further education, often relying on on-line resources and on technology certification providers, rather than on traditional university courses. Although tertiary education appeared to facilitate the entry into the ecosystem for many, some of the participants were highly successful without it.

Annette, who never graduated from university, started low and "learned a lot when I did things like data entry." Success came as she worked very hard, and Annette attributed her success to hard work:

> Working up to 70 hour per week for weeks in a row... my career advanced and I met many people when putting that many hours in.... I learned a lot of transactional things other people did not know, that has nothing to do with product management... that helped me to get my own way.

Elizabeth grew her own IT company, and she sold it 18 months before the interview:

> Did not go to university. . . various professional courses while working. . . none of it is technology related, even though I started technology business, I am not a technology person. . .. It was all about professional networks of my business relationships. . .. I knew the problem very deeply, and that was my contribution to the business to start with. . . networking.

> I did not go to a university, no degree. . . My certifications came later in life, when I knew where I was going. . .. Now I am a certified executive coach. (Jennifer)

Even though joining the ecosystem may be presented as overcoming the barrier of lack of experience, outside talent could also be proactively attracted. Denise, a product designer, was proactively attracted into the ecosystem:

> First IT job almost by accident - someone reached via LinkedIn. . .. I told them I am not necessarily qualified - they told we will give you mentors.

Gender and discrimination

Regarding gender equity in the workplace, the experiences and the perceptions of the respondents varied. Maria, an immigrant from Latin America, is very successful in a highly technical and influential role as an IT architect. She is on track to fulfill her lifestyle goal: "I have a very ambitious plan to retire at the age of 50." She is a working mother and was able to secure flexible work arrangements to allow her to care for her daughter: "flexible not just working from home, but also with the hours." She did not highlight benefiting from an organizational policy intended to support women; rather, she attributed the ability to work flexibly to the nature of her work and to her high performance in her role.

Maria observed that there were particularly few women in her area of specialization (virtualization and cloud computing). She attributed this, in part, to a male-dominated, women-unfriendly culture: "outside work, when there is a technical event, not many women participate because they do not feel very comfortable with those situations." Maria described an experience where a woman was speaking at a technical session "and there were some men in the room who were saying inappropriate things." However, she did not give any examples of herself being disadvantaged because of her gender and she mentioned "I would like to encourage more women to join because this is a very interesting job."

Overall, very few participants had direct experience of being discriminated against based on their gender, although the issue was raised:

> Just because you are female or you are brown, you might feel suppressed, but it's not like the whole company, the whole management, is against you, just one or two people - just do not concentrate on them. (Sunita)

Discrimination was attributed to certain "older white males" and appeared to be perceived as a vestige of the past, rather than the current prevailing practice. Indeed, Sunita also mentioned that "there are people who encourage you, people who support you. . . [and] people who take your opinion seriously, like my management. . .. raise your voice, talk to the management." However, she did feel that discrimination could potentially be highly harmful: "If you start getting suppressed, you are gone."

Indeed, some of the respondents explicitly denied the existence of gender discrimination, either casually —"discrimination is about being part time, not gender" (Pauline)—or more assertively. In this context, one could argue that women are more likely to work part time, so that discrimination against part-time workers is effectively gender-based discrimination; however, Pauline did not perceive it as such.

At the same time, working in a male-dominated industry did present challenges, which were not necessarily in terms of being disempowered:

> One of my first IT jobs - one on a floor with 200 engineers, and there was one other woman on the floor. . .. I was a project manager at the age of 23, and most of those men were in their mid-forties. (Catherine)

However, strategies could be developed to "beat the boys at their own game:"

> I took the admin and management stuff out of the hair of the technicians, and this is how I earned their respect. . .. I never took technical decisions, I never competed head-on with them. . .. This kind of dynamic helped with men because I did not take them head on. (Catherine)

Moreover, by focusing on people, rather than on technical issues, Catherine placed herself in a position that was more powerful than employees with technical expertise. In this respect, even though her experience was gendered (and one may argue that she was excluded from adopting a technical role), her gender did not necessarily put her at a disadvantage.

A similar tension around women occupying technical roles was reported by Dianne, who worked in

a highly technical role and reported a more negative overall experience:

> Men are a problem, do not want to be challenged by someone who is not a typical woman. . .. Most women I met in IT were designers, very few people who are developers like me. . .. There are hardly any women on the market. . . when they get their first job they are put off by the environment.

Working for an Australian company from her NZ home, Dianne reported: "I am the only woman in the company in a technical role." Thus, gender was still relevant when work was remote.

Gendered experiences could come from unexpected directions: "a woman who has a niche of an only female in a male-dominated environment" could discriminate against other women, because "they find you threatening" (Catherine). A similar experience was reported by Marilyn: "[I found] males at job agencies are more supportive of a female than females in the job agencies. . .. Males seem pleased when a female applies."

Most of the respondents reported positive experiences working in IT by emphasizing their success and not mentioning any bad experiences: "very lucky to be a female in this industry. . . values of equality in all companies" (Denise). However, Denise goes on to caution that it "should be harder if you are in engineering, rather than design. . . a lot of older white males in engineering." In contrast, Sandra, working in the highly technical role of a QA analyst, asserted that "more and more women are going into software development, into more senior roles." Heather, a project manager, believed that "being a female in the IT industry you have an advantage because you automatically have better communication skills. . .. I find that people are very respectful toward me." In a similar vein, Lesley, a business analyst, believed that women have attributes that can make them very successful in IT: "women tend to have better communication skills. . . able to maintain relationships."

Shirley, a software programmer, attributed gender imbalance to women's lack of interest in IT:

> Not many women, but may be this is because they are not interested in technical staff. . . most of them are keen to do non-technical things in IT companies. . .. Women are good at communication and teamwork. . .. The environment here is quite nice for women because companies need gender balance.

Some of the participants expressed a negative view of the media discourse around women in IT:

> People are using the whole "women in IT thing" like a "get free out of jail" card, and this really annoys me. . .. People expect getting a job because they are women or expect to get more because they are women and that really annoys me. I do not want to get a job because of my gender, I want to get a job because I am the best fit for the job. It really bothers me when other people, men or women, use "women in IT" as a selling point, it really bothers me. (Maureen)

Alaxandra offered a view that women in IT may be regarded as capitalizing on the discourse about women in IT in a less direct way:

> Regardless of the fact that in the IT industry we have fewer women than men, I never experienced any disrespect or bad attitude. . .. Girls and women are judged by their knowledge, not by the gender. . .. I had a lot of managers who also were female, because they deserved it.

Work-life balance

The ecosystem may indirectly support taking time off for raising children, or other family caring responsibilities, by offering activities such as participation in technical meetups that allow women to maintain connectivity to the network with minimal effort. However, more tangible and direct support remains in the hands of employing organizations. Annette, a product manager, has worked for two global IT companies: "both of them were very supportive of working mothers. . . amazing, amazing HR departments, amazing management." Annette was able to "work from anywhere," and "this was the key for me when returning to work after my second son." Even though Annette ended up with a "network that is still growing today," for her the network was less of an asset when she had to focus on child-rearing.

At the same time, higher earnings and greater control associated with being established as a contractor did offer flexibility for Pamela, an independent contractor for more than 20 years: "I took one year out for my first child, and I took six months out for my second child." Some of the respondents perceived flexibility as an inherent characteristic, and an advantage, of the IT work ecosystem: "working in IT gives women flexibility to be able to work from home. . . attractive if they are raising a family. . . offers an opportunity to travel if they wish. . . very mobile" (Lesley, business analyst). Access to flexible arrangements varied, however, or could come with a downside:

> Work from home - can't get promoted, they do not like people working from home, at least in my company. (Janice)

> Flexible hours would be fantastic, but it's hard to get. . .. I am a developer. . . as a project manager, you might get flexible hours, but as developer, they need you all the time. (Ruth)

At the same time, the need for flexibility varied depending on the person's situation:

> Work is my purpose - need to learn and grow, flexible working not really a necessity, I've got the time and I've got the energy to put into a role. (Suzanne)

Regarding the attributes of an ideal job, flexibility needed to accommodate family responsibilities was often mentioned: "right now that I am a mum, flexible work is key for me" (Maria). However, the most common, and strongly emphasized, attribute was that the job should be interesting and should lead to professional growth thus increasing the worker's value within the ecosystem:

Should be an interesting project—minimal criteria. (Christine)

> I wanted a job that would grow me. . . industry standards of pay or higher, but mainly value growth. (Denise)

The motivation to get a high salary was occasionally downplayed: "I have moved for money before, and it did not turn out to be a good thing" (Lynette). At the same time, not all the participants were career focused in assessing desirable job attributes:

> Flexible hours number one and location. . . not to spend a lot of time in traffic. (Helen)

> No overtime, and then I'd go for the money. (Sunita)

Family circumstances could influence career satisfaction very strongly:

> I worked very hard to get as far as I could in my career before I had a child. And once I had a child, I stopped looking for career progression and just stayed at the same level, but looked for roles with flexibility to go for after school things and to do school drop-offs etc. (Margaret)

Overall, Margaret was satisfied with her career path. Indeed, the work ecosystem allowed her to be engaged in different degrees, depending on her circumstances, while maintaining the connection.

A female subsystem of the ecosystem?

Some of the respondents reported experiences that emphasized the importance of women in IT supporting each other, suggesting the existence of a gendered (women only) network of mutual support:

> [Women] supporting each other. . . especially now that I'm older I am trying to help younger women, so they feel supported. (Judith)

Such support, however, was not a prerequisite for success, as many of the participants who were satisfied with their careers did not mention it.

During a gap year at university, Sharon was working for a law firm when the firm shut down. Her boss, who was a women, started a technology company and asked Sharon to join it. She did so, and she quickly moved into a managerial role. Sharon perceived her experience in IT as gendered, however her gender actually strengthened her position:

> In my job I worked with a lot of women, my CEO is actually female. I know that she struggled with a lot of things being female, raising capital, etc. . .. It is important to have those female figures around you, who are successful and who are running businesses in the industry that is male dominated. My first manager was a female as well, during that time she also had a baby, flexible maternity leave, welcoming her back, that sort of thing, it is really important to have leaders who are female. (Sharon)

Jillian, a consultant, maintained the importance of "maintaining a network of other female colleagues. . . because this is a very male-dominated industry. . .. Comparing stories and giving each other support. . . sharing their experience of how they handled particular situations is really invaluable." Elizabeth, a successful female IT entrepreneur, reported women-to-women support from the perspective of a position of power:

> I would not go work for someone else, I will start another business. . .. I was proud that we had a 50–50 split male-female in our IT development team. . .. Overall in the organization, we had more women than men. . .. We offered flexible hours, unlimited sick leave, part-time work. . .. You empathize with the problem when you have your own children. (Elizabeth)

Discussion

In this section, we interpret the findings reported above from the perspective of the conceptual model depicted in Figure 1, which is an extension of the conceptual model for flexible careers introduced by Tomlinson, Baird, Berg and Cooper.[30] The model suggests that the

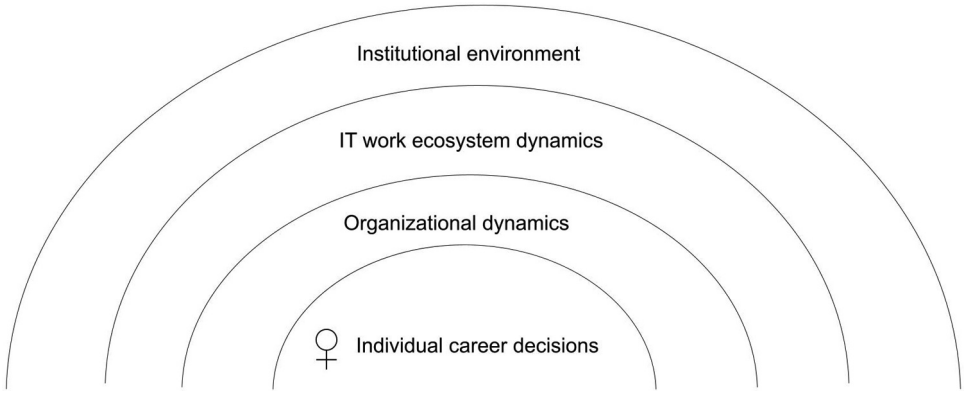

Figure 1. The conceptual model.

experiences of a woman at work—and ultimately, her career—are shaped at four levels of proximity. First, and most immediately, her work experiences are shaped by her own decisions. Second, by the events and practices at the organization that currently employs her, if any. Third, by the work ecosystem formed by organizations offering work in the IT domain, organizations and platforms offering support to IT workers (e.g., education establishments, recruiters, social media), and informal professional and personal networks connecting, or potentially connecting, her to IT work. Fourth, by the institutional environment formed by formal and informal "rules of the game" relevant to IT work, such as employment laws (e.g., regulations about childcare leave) and the (informal) acceptance of men taking childcare leave (thus enabling a mother to focus on her work).

Our contribution to the flexible careers model is the explicit addition of the work ecosystem layer and the emphasis on its centrality. Specifically, a woman's identification with the work ecosystem is stronger than with the current employer, and the ecosystem has resources, such as connections to potential employers, that are not under the control of any single employer. Moreover, as a contractor or as an entrepreneur, a woman IT worker can fully participate in the ecosystem without relying on an employer.

Our analysis of the interview data suggests that women participating in the IT work ecosystem in a variety of ways (e.g., full-time and part-time employees, contractors, entrepreneurs) were, overall, satisfied with their experiences. Thus, one can argue that their careers were successful irrespectively of how high they achieved in terms of income or power.

The difficulty of the initial entry into the ecosystem (the first IT job) varied considerably, and for many it was a natural progression from work in related areas (it just happened). Connections via friends and family could be instrumental, and hard work could compensate for the lack of relevant experience or connections. Once a part of the ecosystem, the dynamics of the ecosystem acted to maintain and to upgrade the connection, with new opportunities arising naturally. Although a number of the participants took time off from work to look after children, none of them reported having difficulty resuming IT work. Indeed, this appeared to be considerably less of an issue than finding the first IT job. Introducing the concept of work-life integration, Alok, Banerjee and Kumar[22] emphasized the role of employers. Our results suggest that the broader work ecosystem also plays a role, as suggested in the conceptual article by Subramony, Solnet, Groth, Yagil, Hartley, Kim and Golubovskaya.[19]

None of the participants' accounts were alike, suggesting that the ecosystem provided a broad range of possibilities and that there were few institutional constraints imposing particular patterns of career progression. For example, not having a tertiary education did not preclude participation and success, and it was possible to shift from single-minded focus on career achievement to focusing on children, if desired.

The richness of possibilities offered by the ecosystem is consistent with the concept of work-life enrichment[22] – career experiences fitting the life circumstances of individual women were often possible. By identifying with the ecosystem, the participants managed the risk of work-life strain, as they were less likely to be bound by the practices or human resource realities of a particular organization. Such richness is consistent with the overall metaphor suggested by the kaleidoscope career model. However, the specific sequence of phases suggested by the model—focus on challenge, then on flexibility, and then on authenticity—was not fully pronounced in the data. Specifically, the pattern of focus on challenge followed by focus on flexibility was visible, as a consequence of the need to care for children, but

authenticity could be salient at any point in the career (e.g., many of the participants voiced preference for working on projects that were consistent with their values).

As to gender-based discrimination and problems with being part of a male-dominated workplace, the experiences varied. Even though many of the barriers suggested by Ahuja's[31] model were mentioned, for most of the participants they did not dominate the work experience. Most of the participants did report a gendered experience (i.e., gender did matter), but they were often able to turn the difference to their advantage. Many of the participants felt that what they saw as female attributes (e.g., a better ability to work with people and in groups) landed them in positions (e.g., project management, sales) that were superior to purely technical positions in terms of power, renumeration, and/or autonomy. Further, some of the participants found inspirational female role models or participated in female-only informal professional support networks.

The participants' perceptions of the media discourse around women in IT varied—some of them internalized the discourse and others explicitly spoke out against it. The relationship between success and the extent of agreement with the discourse was not always straightforward. Analysis of the data indicated that participants who were successful in terms of achieving powerful positions could support the discourse. On the other side, those who, analyzing their circumstances, were disadvantaged (e.g., because of having to devote time to children), did not necessarily perceive themselves as such.

According to Singh and Vanka,[35] the leaky pipeline perspective by Ahuja[31] implies a linear progression through an IT career and obscures a woman's agency in her career. Our analysis supports this point of view. The barriers and the leaky pipeline perspective are overly prescriptive of the definition of success. One may argue that if a woman finds shifting from an emphasis on conventional career progression to an emphasis on family or, even, on overseas travel, as described by Myers, Thorn and Doherty,[36] a satisfactory experience, then this career path should be deemed as a success.

The present study contributes to theory by applying the flexible career model developed by Tomlinson, Baird, Berg and Cooper[30] in the context of women's employment in IT. Furthermore, we extend the model by adding the concept of IT work ecosystem and by emphasizing its centrality to women's experiences. The results suggest that to improve the quality of women's work experiences, and to facilitate their entry into the ecosystem, they should be given time and resources to participate in the broader ecosystem directly (e.g., by attending technology meetups or boot camps).

A limitation of the present study is that only women currently employed in IT roles were interviewed; a broader understanding could be achieved if data were also collected from those who left the ecosystem (e.g., did not return to an IT job after a maternity leave) or attempted and failed to join it (e.g., searched for, but did not find an IT job). Understanding the experiences of the IT work ecosystem by women who were left outside it is a topic for further research.

Disclosure statement

No potential conflict of interest was reported by the author(s).

ORCID

Alexei Tretiakov http://orcid.org/0000-0002-1949-8078
Tanya Jurado http://orcid.org/0000-0002-7171-6861
Jo Bensemann http://orcid.org/0000-0002-4975-4247

References

1. Venkatesh V, Windeler JB, Bartol KM, Williamson IO. Person–organization and person–job fit perceptions of new it employees: work outcomes and gender differences. MIS Q. 2017;41(2):525–58. doi:10.25300/MISQ/2017/41.2.09.
2. Armstrong DJ, Riemenschneider CK, Giddens LG. The advancement and persistence of women in the information technology profession: an extension of ahuja's gendered theory of it career stages. Inf Syst J. 2018;28(6):1082–124. doi:10.1111/isj.12185.
3. Annabi H, Lebovitz S. Improving the retention of women in the it workforce: an investigation of gender diversity interventions in the USA. Inf Syst J. 2018;28(6):1049–81. doi:10.1111/isj.12182.
4. Gorbacheva E, Beekhuyzen J, Vom Brocke J, Becker J. Directions for research on gender imbalance in the it profession. Eur J Inf Syst. 2018;28(1):43–67. doi:10.1080/0960085x.2018.1495893.
5. Haddad CJ. Ungendering technology: women retooling the masculine sphere. Abingdon, Oxon; New York, NY: Routledge; 2019.
6. Gupta B, Loiacono ET, Dutchak IG, Thatcher JB. A field-based view on gender in the information systems discipline: preliminary evidence and an agenda for change. J Assoc Inf Syst. 2019;20(12):1870–99. doi:10.17705/1jais.00588.
7. Harmon K, Walden E. Comparing three theories of the gender gap in information technology careers: the role of salience differences. J Assoc Inf Syst. 2020;22(4):1099–145. doi:10.17705/1jais.00690.
8. Vainionpää F, Kinnula M, Iivari N, Molin-Juustila T. Girls in it: intentionally self-excluded or products of

high school as a site of exclusion? Internet Res. 2020;31 (3):846–70. doi:10.1108/INTR-09-2019-0395.
9. Serenko A, Turel O. Why are women underrepresented in the American it industry? The role of explicit and implicit gender identities. J Assoc Inf Syst. 2021;22 (1):41–65. doi:10.17705/1jais.00653.
10. Trauth E, Connolly R. Investigating the nature of change in factors affecting gender equity in the it sector: a longitudinal study of women in Ireland. MIS Q. 2021;45(4):2055–100. doi:10.25300/MISQ/2022/15964.
11. Molnar A, Keane T, Stockdale R. Educational interventions and female enrollment in it degrees. Commun ACM. 2021;64(3):73–77. doi:10.1145/3387106.
12. Panteli N, Urquhart C. Job crafting for female contractors in a male-dominated profession. New Technol Work Employ. 2021;37(1):102–23. doi:10.1111/ntwe.12210.
13. Tokbaeva D, Achtenhagen L. Career resilience of female professionals in the male-dominated it industry in Sweden: toward a process perspective. Gend Work Organ. 2023;30(1):223–62. doi:10.1111/gwao.12671.
14. Richterich A. Work hard, fit in, and applaud her: women developers blogging about their lived experiences. Int J Cult Stud. 2020;24(2):342–59. doi:10.1177/1367877920941026.
15. Burnes PT. Voluntary employee turnover: why it professionals leave. IT Prof. 2006;8(3):46–48. doi:10.1109/MITP.2006.78.
16. The inside scoop on independent contract work in the it industry TalentEgg 2023 [accessed 2023 July 8]. https://incubator.talentegg.ca/2013/03/06/scoop-independent-contract-work-industry.
17. Seibert SE, Kraimer ML, Liden RC. A social capital theory of career success. Acad Manage J. 2001;44 (2):219–37. doi:10.2307/3069452.
18. Velenturf AP, Jensen PD. Promoting industrial symbiosis: using the concept of proximity to explore social network development. J Ind Ecol. 2016;20(4):700–09. doi:10.1111/jiec.12315.
19. Subramony M, Solnet D, Groth M, Yagil D, Hartley N, Kim PB, Golubovskaya M. Service work in 2050: toward a work ecosystems perspective. J Serv Manage. 2018;29(5):956–74. doi:10.1108/josm-05-2018-0131.
20. Cooper R, Baird M, Foley M, Oxenbridge S. Normative collusion in the industry ecosystem: explaining women's career pathways and outcomes in investment management. Hum Relat. 2021;74(11):1916–41. doi:10.1177/0018726720942826.
21. Litchfield RC, Hirst G, van Knippenberg D. Professional network identification: searching for stability in transient knowledge work. Acad Manage Rev. 2021;46(2):320–40. doi:10.5465/amr.2017.0388.
22. Alok S, Banerjee S, Kumar N. Will she stay or will she quit: determinants of career persistence and non-persistence amongst women workers of india's it sector. South Asian J Bus Stud. 2021. doi:10.1108/sajbs-08-2020-0276.
23. Zacher H, Froidevaux A. Life stage, lifespan, and life course perspectives on vocational behavior and development: a theoretical framework, review, and research agenda. J Vocat Behav. 2021;126:103476. doi:10.1016/j.jvb.2020.103476.
24. Sullivan SE, Arthur MB. The evolution of the boundaryless career concept: examining physical and psychological mobility. J Vocat Behav. 2006;69(1):19–29. doi:10.1016/j.jvb.2005.09.001.
25. Mirvis PH, Hall DT. Psychological success and the boundaryless career. J Organ Behav. 1994;15 (4):365–80. doi:10.1002/job.4030150406.
26. Hall DT. The protean career: a quarter-century journey. J Vocat Behav. 2004;65(1):1–13. doi:10.1016/j.jvb.2003.10.006.
27. Hall DT, Moss JE. The new protean career contract: helping organizations and employees adapt. Organ Dyn. 1998;26(3):22–37. doi:10.1016/S0090-2616(98)90012-2.
28. Mainiero LA, Sullivan SE. Kaleidoscope careers: an alternate explanation for the "opt-out" revolution. Acad Manage Exec. 2005;19(1):106–23. doi:10.5465/ame.2005.15841962.
29. August RA. Women's later life career development: looking through the lens of the kaleidoscope career model. J Career Dev. 2011;38(3):208–36. doi:10.1177/0894845310362221.
30. Tomlinson J, Baird M, Berg P, Cooper R. Flexible careers across the life course: advancing theory, research and practice. Hum Relat. 2018;71(1):4–22. doi:10.1177/0018726717733313.
31. Ahuja MK. Women in the information technology profession: a literature review, synthesis and research agenda. Eur J Inf Syst. 2002;11(1):20–34. doi:10.1057/palgrave.ejis.3000417.
32. Creswell JW, Poth CN. Qualitative inquiry and research design: choosing among five approaches. Thousand Oaks, CA: Sage publications; 2016.
33. Brinkmann S. Qualitative interviewing. Oxford: Oxford university press; 2013.
34. Braun V, Clarke V. Using thematic analysis in psychology. Qual Res Psychol. 2006;3(2):77–101. doi:10.1191/1478088706qp063oa.
35. Singh S, Vanka S. Career break, not a brake on career: a study of the reasons and enablers of women's re-entry to technology careers in India. Bus Perspect Res. 2021;9 (2):195–214. doi:10.1177/2278533720964328.
36. Myers B, Thorn K, Doherty N. Self-initiated expatriation and older women: composing a further life. Personnel Rev. 2022;51(3):1120–37. doi:10.1108/PR-11-2019-0638.