



Dynamic Career Path Decision Support Systems: A Design Perspective

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Abstract

Determining a quality career path in terms of effectiveness and efficiency requires considerable research and communication due its pivotal effect on the individual and society as a whole. It requires careful and full understanding of one's own competencies, possible opportunities/ options, information/knowledge linkage and challenges/changes that may be encountered. This paper explores and discusses the notion of career planning in general and its relevance to establishing educational decision support systems in particular. It highlights and explores the main career path (CP) processes. It investigates its dynamic elements/ properties, benefits and challenges. The paper proposes a Dynamic Career Path Decision Making (DCP-DSS) Model and concludes with recommendations for future research towards establishing dynamic frameworks that inform the development of Dynamic Career Path Decision Support Systems DCP-DSS to help students make informative, effective and efficient career path decisions.

Keywords: Career Path Processes (CPP), Dynamic Career Planning Processes, Interactive Education Systems, Educational Decision Support Systems, Dynamic Career Path Decision Support System (DCP-DSS).

1 Introduction

Previous research conducted by Education and Employment (2015) reveal that the UK labour market has become more complex compared to the past. Consequently, it increasingly becomes more difficult for the young generation to make informed decisions about their education and training, adding to the significant mismatch between skills possessed by young people and skills demanded by the labour market, resulting in the need for higher quality careers provision. Despite that many universities provide some important and relevant programs for solving existing problems, they are considered in most cases reactive rather than proactive (Abdelhakim and Sabry, 2009). Moreover, universities' completion rates records represent some signs of uncertainty surrounding students' choices as well as possible challenges facing them, taking into account that completion rates vary from a country to another. A report released by the European Commission (EC) compared students' completion rates across some European countries (Bothwell, 2016) showed the highest completion rate of 82% (UK) and the lowest rate of 59% (Norway): Further, according to Denholm (2016), Scottish universities had the highest student drop-out rates compared to other UK universities, figures showed around

8% students' drop out before the start of the second year compared to a UK average of 7.2%. A research published in 2015 found that AU students' completion rate was lower for some particular groups including: Indigenous students, part-time students, external students, students over 25 years, remote students and students from low socio and economic backgrounds (Moodie, 2016).

On the other hand, Belo and Oliveiraa (2015) conducted a research involved successful and unsuccessful university students. The research analysed the academic experience (dimensions: personal, interpersonal, career, study, institutional) and their academic expectation (dimensions: institutional involvement, vocational involvement, resources use, social involvement and curricular involvement). The research took into consideration certain elements such as: student's time management and study skills; work habits; use of library and others facilities; in addition to variables such as: sociocultural, economic and intuitional. The research highlighted the importance of the institutional interactions and role in realizing students' expectations as well as experiences and in turn improving students' university learning experience, value and reducing students' dropout rates. Javidi and Sheybani (2017) also conducted a study that highlighted the importance of analysing the characteristics/experiences of those who continued in the computer science program in order to establish the appropriate strategies/ programs that help improving students' retention. The study stressed the importance of understanding the academic and non-academic factors that may influence students' continuation and performance such as: self-perception, self-confidence, financial constraints, faculty members' encouragement, peer encouragement, tutoring programs, internship and undergraduate research, quality of advising and the quantity and quality of faculty–student interaction (See Abdeldayem & Aldulaimi, 2020 & 2021).

Some studies found that 'most students change majors at least once and many switch several times' (CollegeBoard, 2019). Paura, and Arhipova (2014) conducted a study to find out the reasons for students dropout in the first year of faculties of engineering. The results showed that approx. 34.4% of students leave depending on the type of curriculum taught and students' secondary school grades, i.e. students' low secondary school performance as well as low motivation to study the engineering subjects. Another survey study was conducted to investigate the withdrawal and dropout in Brazil's private higher education and found that: older students, marital status change during the course of study, and funding related issues were causes of dropouts (Bonaldoa. and Pereirad, 2016).

In terms of graduates' employment, according to the Office for National Statistics (ONS), half of UK graduates, up to 47% landed non-graduate jobs (Allen, 2013). An article by Bloomberg (Lorin and Smialek, 2014) indicated that college graduates were facing problems finding jobs, with an unemployment rate for college graduates ages 22-27 at 5.6%, and that more than 50% of 22 years old who found jobs in the last 3 years were in roles that do not require a college diploma. According to Espinoza (2015) a third of those graduates who took jobs, worked as cleaners, office juniors and road sweepers 6 months after they left university. Over sixty thousand students took "*non-professional*" positions, such as secretaries, caring jobs, sales and customer services. *Overall, around 7% of UK and EU full-time students who completed their first degree in the 2013/14 were assumed to be unemployed.* According to The Higher Education Statistics Agency (HESA) the percentage of jobless graduates varied from one degree subject to another. Those who studies certain degrees subjects had little or no unemployment (e.g. medicine, dentistry and subjects linked to medicine), while those who studies computer science had 11% unemployment and those who studies engineering and technology had 8% unemployment (Espinoza, 2015).

Therefore, the above literature highlighted some important elements and factors that should be taken into consideration by educational institutions such as: student academic experience (dimensions: personal, interpersonal, career, study, institutional); student academic expectation (dimensions: institutional involvement, vocational involvement, resources use, social involvement and curricular involvement); student's time management and study skills; work habits; use of library and others facilities; sociocultural, funding, economic and intuitional aspects; institutional involvement and role in realizing students' different expectations and experiences; students' secondary school performance as well as student's motivation towards program subjects; parents and family members support and encouragement; faculty members' encouragement, peer encouragement, the quantity and quality of faculty–student interaction, tutoring programs, internship and undergraduate research, the need for higher quality advising, higher quality careers provision and proactive solutions.

The following sections will look into more details, different aspects, angles, factors and determiners that need to be taken into consideration and may contribute to students' dynamic career path decisions, towards a more effective and efficient dynamic framework that helps institutions and students to make a more dynamic, informed and relevant career path decisions, which in turn inform the development of DCP-DSS.

2 Research Methodology

Institutions need to prepare students for the next information generation era that is characterised as volatile, continuously changing and dynamic (Sabry and Barker, 2009). The aim of this research is to explore some of these issues, including possible challenges that may be encountered. This review looks at different angles of career path decision making processes, towards a more effective, efficient and dynamic framework that helps students to make more relevant and informed career path decisions.

The research methodology used in this paper is based on reviewing available literature, focusing mainly on published literature on career path processes, decisions making and closely related fields (Abdeldayem et al 2021 % 2022). It presents available statistics, up-to-date sources, analysis, and critiques. The review aims to identify, provide an understanding of issues, unresolved questions, difficulties and highlight some factors that may contribute to its success. It tries to answer the questions: What are considerations and factors that may help improve the career path decision making process? What are the challenges/ obstacles that need to be highlighted? Therefore, this paper's sought contributions are: better understanding of different factors affecting career path decision making processes

3 Career Path Decision Making Factors

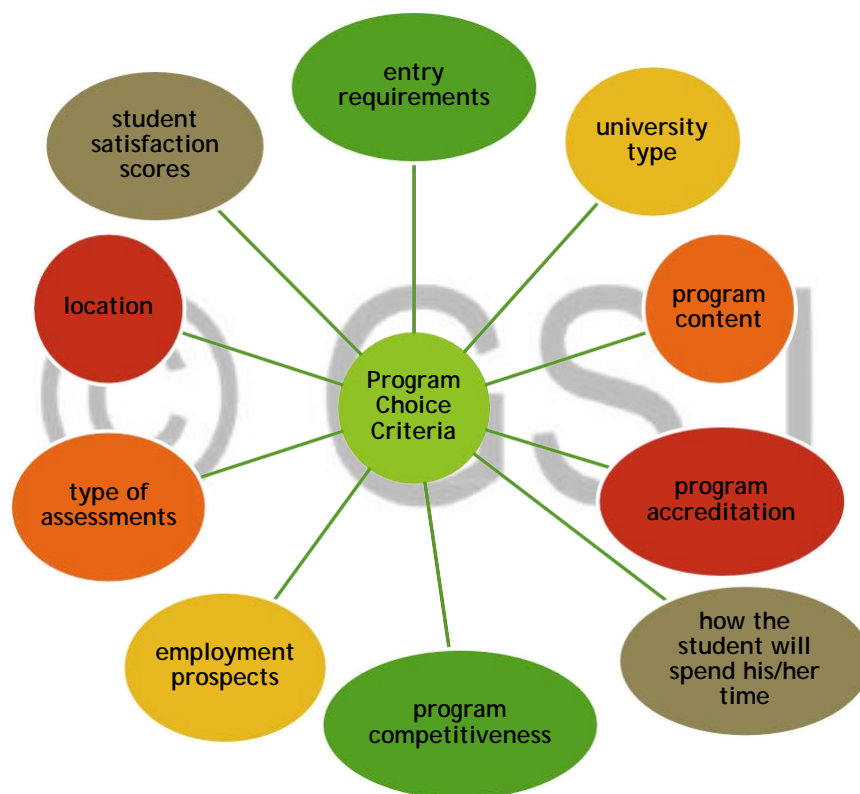
Career path decision making involve taking many interrelated and overlapping decision making processes including (but not limited to): choices of program/ study area, university's reputation, academic facilities, graduates' employment rates, types of jobs, possible opportunities, etc...

3.1 Factors that influence student's choice of study program/ course

University applicants were asked to identify the main factors that contributed to their choice of a university program. The top five factors were: program

content, overall academic reputation, graduate employment rates, the quality of the academic facilities and links between the university and employers, with the program content ranked highest and links between the university and employers ranked lowest (CUG, 2016). A similar university's applicants were also asked to identify the main five factors that contributed to their choice of a university program. The top factors were: program Content, academic reputation, the quality of the academic facilities, league table rankings and the type of work involved, with the program content ranked highest and the type of work involved (Hughes, 2016). Further, Gardner (2016) listed 10 criteria for students to look for when choosing their suitable programs including: program entry requirements; type of university; location; student satisfaction scores; how the student will spend his/her time; program content; how the student will be assessed; graduate employment prospects; professional program accreditation; program competitiveness

Figure 1 Program choice criteria



Source: Gardner (2016)

On the other hand, an interesting and detailed work was done by Kent University, Careers and Employability Service to help students plan their career path (Kent University, 2016), using a web-based information system. The work was intended to help students to recognise their potential and opportunities through a comprehensive analysis of multiple factors. The work identified 4 essential processes or phases respectively for choosing a career (refer to Figure 2): Self-awareness (self-analysis including skills, values, interests and personality); Opportunity awareness (opportunities analysis); Decision making; Taking action.

Figure 2 Factors that influence student's career path decision.



Source: Kent University (2016)
<https://www.kent.ac.uk/careers/Choosing/choosingintro.htm>

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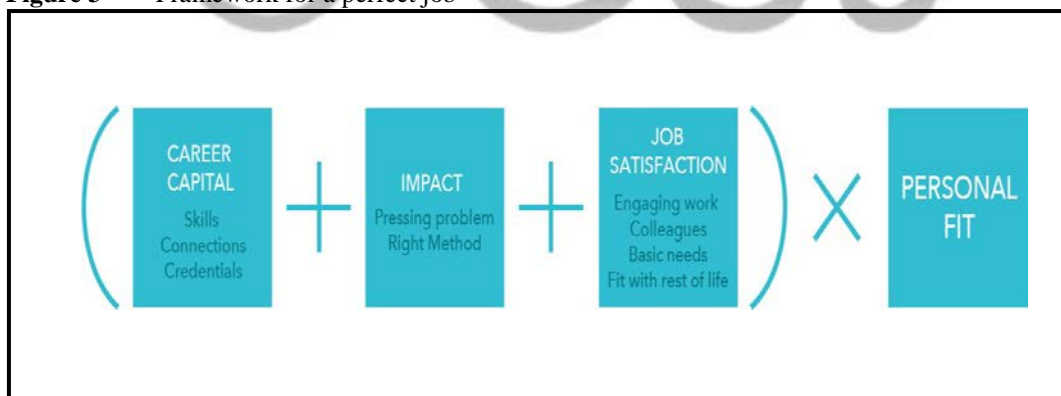
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Encouraging students to search and seek the relevant information, can be for example in the form of reading about the profession they like, talk to those in the profession, how they developed their career, what education they did, etc. Also, learning through practice and experimenting through joining relevant community groups or summer activities, this may help them finding out whether they want to continue or change direction (Zimmerman, 2009). Further, Abdelhakim (in press) proposed DSS to help UAE students selecting suitable universities and college programs using a pre- determined set of criteria.

3.2 Factors that influence student’s choice of jobs

In some cases, the ideal job can be described as the one that: fulfils one’s passion, good pay and not difficult to do. However, based on more than 60 studies of what a dream job should be, it was found that people rate highly work that is engaging, challenging- but achievable, helps others (e.g. contributing to society), that one’s good at (not only passionate about), is supported by colleagues, that does not comprise major negatives (e.g. a long commute, very long hours, pay you feel is unfair, job insecurity), and work that fits nicely with one’s personal life (Todd, 2017a). Using such elements may help in differentiating between different jobs. Self-reflection may be helpful in determining a career, begin for example with writing out a list of what one’s want most from a job (e.g. “working outdoors” and “working with ambitious people”, etc.), hoping to go deep down enough, assuming that people really know what they want. However, research has shown that we’re bad at predicting what will make us most happy and often people judge the pleasure of an experience by its ending (Gilbert, 2007). Despite that high income improves evaluation of life but not emotional well-being (Kahneman and Deaton, 2010; Aldulaimi et al., 2021). Todd (2017b) suggested the following formula or framework for analysing real career decisions (refer to figure 3 and table 1).

Figure 3 Framework for a perfect job



Source: Todd (2017b)

Todd suggested the following process (see table 1) to narrow down possible options: firstly, making a big list of career options; secondly, ranking the options, using 5 factors’ scores from 1-5 to filter the options list. Five factors are used here: career impact (the extent to which the role gives student opportunities for a better position for future impact), personal fit (the extent to which student will be able to take advantage of these opportunities), supportive conditions for job satisfaction (which option may give the student the highest job satisfaction, engage and fit best with the rest of his/her life?), other possible factors important to individual students

(e.g. individual differences), and career capital (which option will put student in the best position for the future?); thirdly, writing out the main uncertainties which may change the ranking of options (e.g. would programming be enjoyable?); fourthly, doing some initial research, trying to check the above uncertainties (e.g. talking to someone in the area of programming, finding relevant readings, doing cheap tests with minimum time possible, volunteering, internships, etc.). Todd (2017c) stressed that career plan should not be considered a fixed plan. People learn and change, the world also changes, consequently, there is no one single right career (Todd, 2017c).

Table 1 Using the 5 factors' scores from 1-5 based on Todd (2017b)

Factors	Career Capital	Career Impact	Career Supportive Conditions	Career Personal Fit	Other Individual Factors
Options					
Option 1					
Option 2					
Option 3					
Option 4					
Option 5					
Option ...					

3.3 Factors that influence student's choice of a University

Section 3.1 listed some factors that influence university programs' selection. University ranking reports can also be helpful to give the student an overall picture of the universities' performance to select from. Some of the well-known university ranking methodologies used are: QS World University Rankings®, Times Higher Education World University Rankings, and the Academic Ranking of World Universities (ARWU). According to Top Universities (2017), each methodology uses certain criteria or performance indicators. Top Universities (2016) further advised that precaution should be taken in using such methodologies. Despite that, the above methodologies are considered helpful to a certain extent, as they give the student an overall picture of the universities' performance (based on the criteria used), there are some aspects that should also be taken into consideration such as: rankings in most cases do not show the full picture, especially that some methodologies may not include small, young as well as highly specialized institutions; Some universities with relatively similar scores may be separated by several ranking places; Rankings can change from year to year; Different methodologies use different factors compare to others. Some rankings put more emphasis on research performance, others put emphasis on employer reputation etc.; There are many choices of reputable universities that have great resources and facilities, despite in some cases having lower rankings!; The universities that are at the highest ranking table are not necessarily the best fit for every students' particular need; Subject-specific rankings provide a good picture of high-performing universities in specific academic areas and can help the student compare departments/schools worldwi

4 Technological tools for career planning

Many website offer different methods to help students choosing their career paths. Some websites such career-test website provides career tests helping individuals to find what types of careers and roles they can play based on their personality test (CareerTest, 2015). Others provides detailed explanation of the process of choosing a career path including for example, 6 main themes: defining what success means, creating the chosen Lifestyle, becoming an expert, loving the chosen industry, tapping into own natural talents, and being appreciated/acknowledged (ThePerfectJob, 2016). Others may help people to know what they are looking for to plan their dream career through filling a few sentences' blanks to find out kind of patterns, common themes, values, and possibly eliminating some possibilities or options (The Muse, 2013). Some use another type of personality test that give the student real life situations or scenarios and asking how he/she would react. Based on the student selections, some careers will be suggested that might interest the student. (DeVry University, 2016). Some others help students to first make their decision based on identifying their interests, values, skills and personality preferences (DePaul, 2016).

Further, some authors suggested several ways to help building and finding a career path, including: thinking about what excites and energizes one's self while keeping in mind what one's is good at, taking a career test, trying an internship, finding a mentor, possibly exploring unconventional careers, consulting other people, considering one's Gifts + Passions + Values, making a career plan, visualising one's career not as a linear path, but as a set of stepping stones (Pinola, 2014). Some considered different ways of trying a career as important steps to find the right and preferred career path, including for example: shadowing/ observing someone, getting an internship and volunteering (Slide, 2016). The Universities and Colleges Admissions Service (UCAS) provides information, advice and a sort of centralised admissions services for students applying for higher education institutions including undergraduates and postgraduates (UCAS, 2018a). UCAS website provides support to students to help them choose courses through search tools (e.g. by course title, Institution and Location), apply and track their application, as well as providing financial related information. UCAS website provides support to students to help them know themselves, identify their strengths and weaknesses through a buzz quiz, using Myers-Briggs personality type (Judging / Perceiving; Thinking / Feeling; Sensing / iNtuiting; Extraversion / Introversion) through asking different types of questions and then mapping job roles and areas that are most suitable, for example as: Sports coach, Nurse, Writer, etc. (UCAS, 2018b).

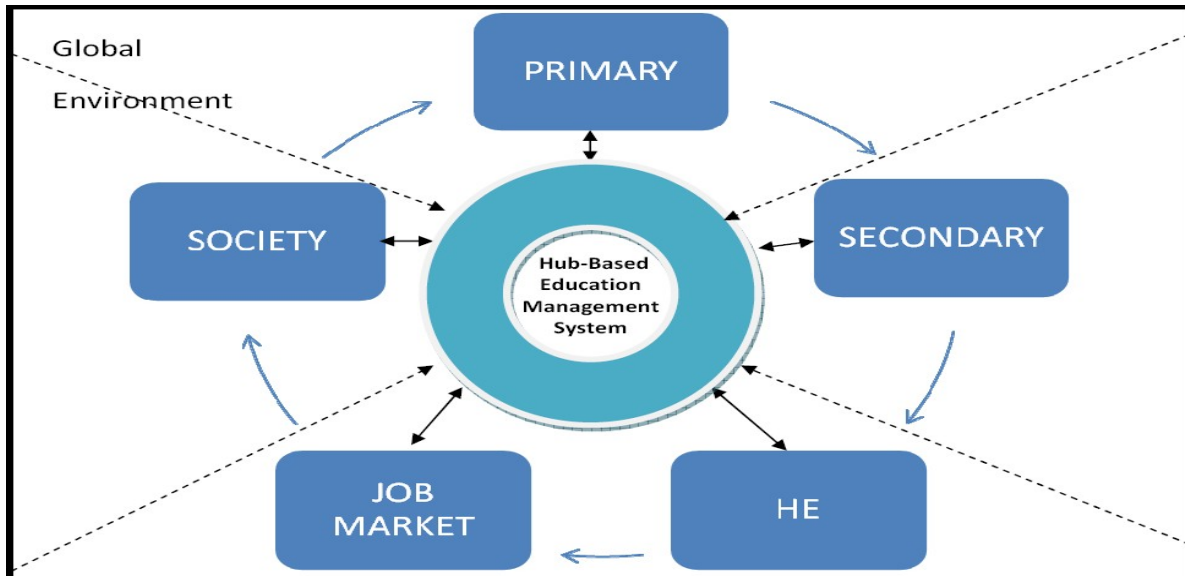
5 Dynamic educational information systems for CP Selection

5.1 Applying the dynamic principles for accommodating continuous changes

It is essential to develop and create dynamic educational information systems that allow for continuous changes. Paul (1993) suggested the Living System paradigm and the Gardening analogy where trimming, alterations, and continuous maintenance are must for Information Systems design. Abdelhakim and Sabry (2009), stressed the importance of establishing a global way of thinking, that accommodates continuous changes, demands and needs, based on processes integration, dynamic and interactive information, in order to help both parents and students to make decisions at any point of time that will eventually have effect on the future of students, families and the society as a whole whether positively or negatively dependent on the quality of information, knowledge, statistics and predictions provided. Abdelhakim and Sabry

(2009) proposed a Hub-based Education Management System Model (H-EMS Model) that not only caters for job market skills requirements but also considers all stakeholders, including: students, parents, instructors, instructional designers, curricula developers, researchers, educational managers, government/ education council, and employers.

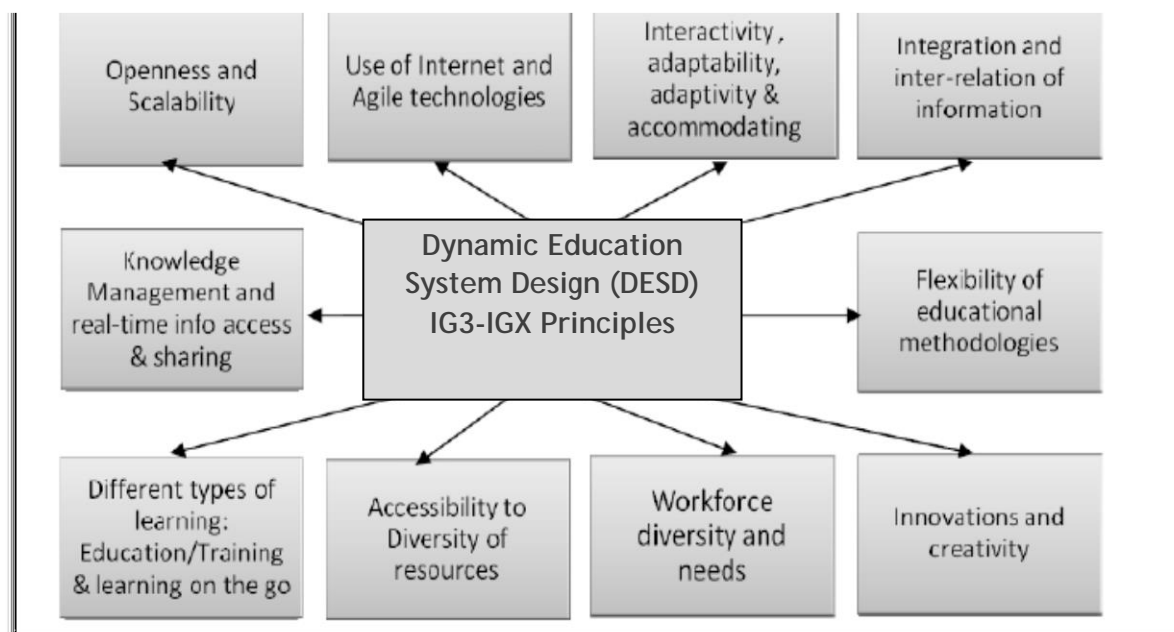
Figure 4 A Hub-based Education Management System Model (H-EMS Model)



Source: Abdelhakim and Sabry (2009)

Linking university programs and research to industry and communities' needs are essential. This system way of thinking requires Universities to think outside the box and develop effective strategies that promote innovation, anticipation, prediction, close industry collaboration and research. Systems thinking is an important concept that links together various information in a holistic, harmonic and orchestrating way within the global environment. Systems thinking helps in monitoring and viewing multiple inputs being processed to produce outputs (Baltzan, 2016).

Figure 5 Dynamic Education System Design (DESD) IG3-IGX Principles



Source: Adapted & modified from: Sabry and Barker (2009)

Despite that some research focused on the influences of student’s success, research is rare in this area, particularly research that takes the international dimension in terms of comparison related issues, plus the low availability of cross-country overviews of completion rates (HEDOCE, 2015), suggesting the need for coordination action across national borders for obtaining up-to-date, sufficient and reliable knowledge base on what works (HEDOCE, 2015).

5.3 The Web/Internet technologies

The Web/Internet technologies play an essential role as a core component of dynamic systems. The Web/Internet created a global framework, not only for its support for information integration, but also for its features such as global reach, ubiquity, interactivity, richness, universal standards, Information density, personalization/ customization, and social technology (Laudon and Laudon, 2016). According to the latest international statistics conducted by the Internet World Stats (IWS, 2018), the world population reached over 7.5 billion, with Internet users reaching over 4 billion users. Further, using the Internet/Web technologies, Cloud Computing became an important component of dynamic systems, which is described as ‘a style of computing in which scalable and elastic IT-enabled capabilities are delivered as a service using Internet technologies’ (Gartner, 2019). With the continuous and nonstop evolution of the Web/Internet, unlimited opportunities and creative solutions are arising, one of which is the Internet of Things (IOT) as one of the rising technological connectivity drivers for Dynamic Systems. Data Analytics (DA), Artificial Intelligence (AI) and Machine Learning (ML) are also essential components for Dynamic Systems. While generally Information Systems enable cross-functionality and the integration of processes, DA enables the analysis of data relationships, patterns and trends for supporting decision making.

5.4 *Courses design and labour market needs*

Brielmaier and Kuo (2015) argued that course design quality can have a positive effect on students' satisfaction, learning motivation and performance. Further, a research conducted by Education and Employment (2015), stressed that: 'Schools must stop trying to predict the future', instead 'they should try to prepare young people for the change they will experience'. Highlighting the need for schools to start preparing students for new jobs which may not yet exist rather than the ones that already existed years ago, for example, through the *integration and injection of new education elements such as entrepreneurship education into all subjects*, giving students those skills, capabilities and attributes that are needed for the modern labour market. The research highlighted an important point, the need of having access to quality up-to-date information signaling what that labour market actually needs in order for quality informed investment decisions to be made, allowing individuals to 'build a profile which will ultimately optimise chances of good education to work transitions'.

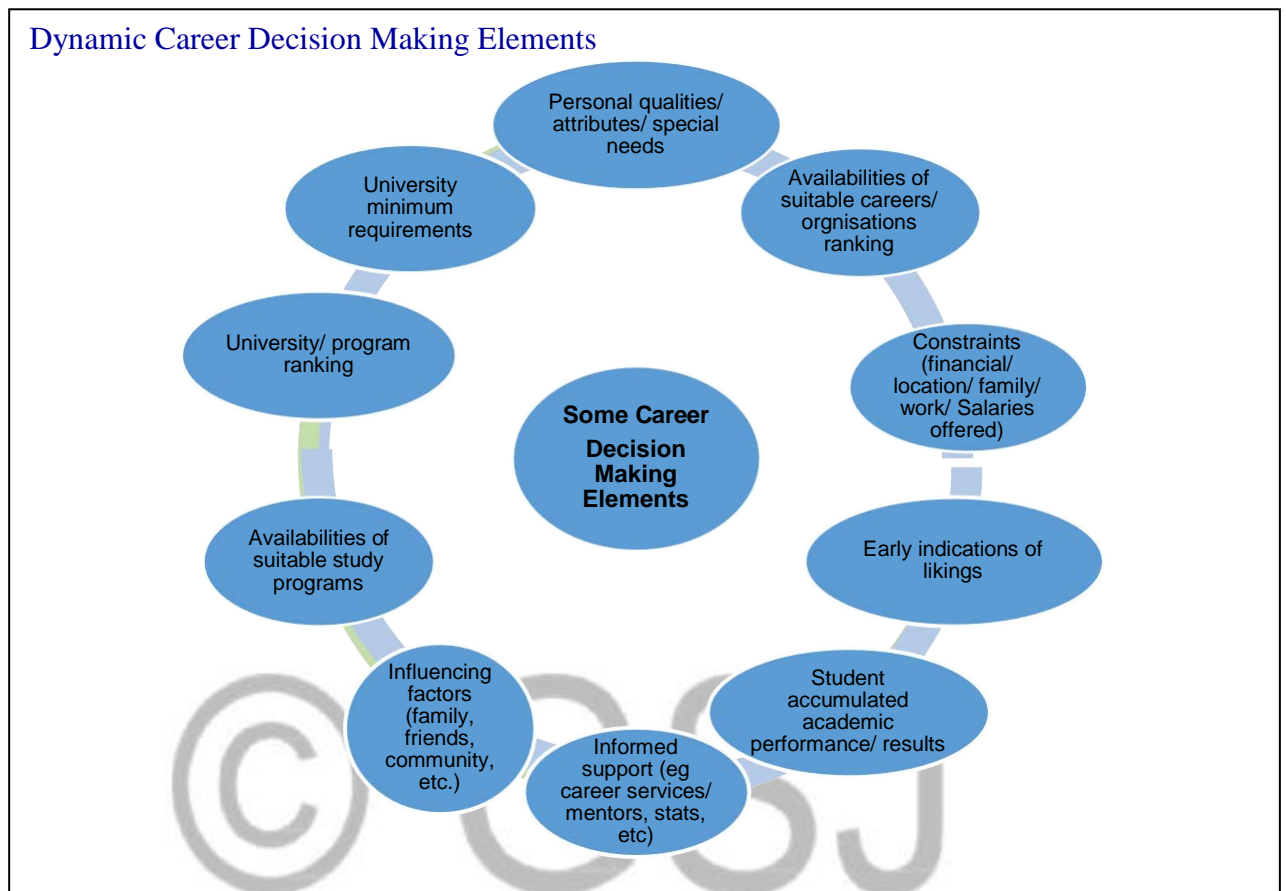
Other institutions considered Internships as also an important component of curriculum design that promote students engagement with industry/ workplace. Internships are describe as, a period of work experience, students undertake during their studies to gain hands on experience and skills in certain areas of their studies, would help them to a certain extent to learn, understand and explore certain work areas and real life roles (Prospects, 2017). Further, it may also help in providing networking opportunities and making decisions whether this is the type of job or role they would like to do. An additional important benefit of internships, is helping students to secure jobs and helping employers select the candidates they need for their business. According to the annual survey 2016 conducted by the Association of Graduate Recruiters (AGR), 36% of graduate intakes in the UK were from previous interns (Prospects, 2017). Further, according to Matthews (2017), there had been some increase, of dual study programs in Germany that combine academic and vocational learning. A survey was conducted in eight European countries which revealed that, 30% of respondents wanted more vocational education and training (VET) compared to 17% who chose higher education, suggesting that, probably one of the driving reasons for vocational education across southern Europe, could be the high levels of youth unemployment (Matthews, 2017).

6 **Discussion and reflection**

6.1 *Dynamic career decision making elements*

Based on the above literature, there are several career decision making elements and factors as represented in the illustration below. These include (but not limited to): personal qualities/ attributes/ special needs; availabilities of suitable careers/ orgnisations ranking; constraints (financial/ location/ family/ work/ salaries offered; early indications of likings; student accumulated academic performance/ results; informed support (eg. career services/ mentors, stats, etc); influencing factors (family, friends, community, etc.); availabilities of suitable study programs; university/ program ranking; university minimum requirements, e

Figure 6 Dynamic Career Decision Making Elements



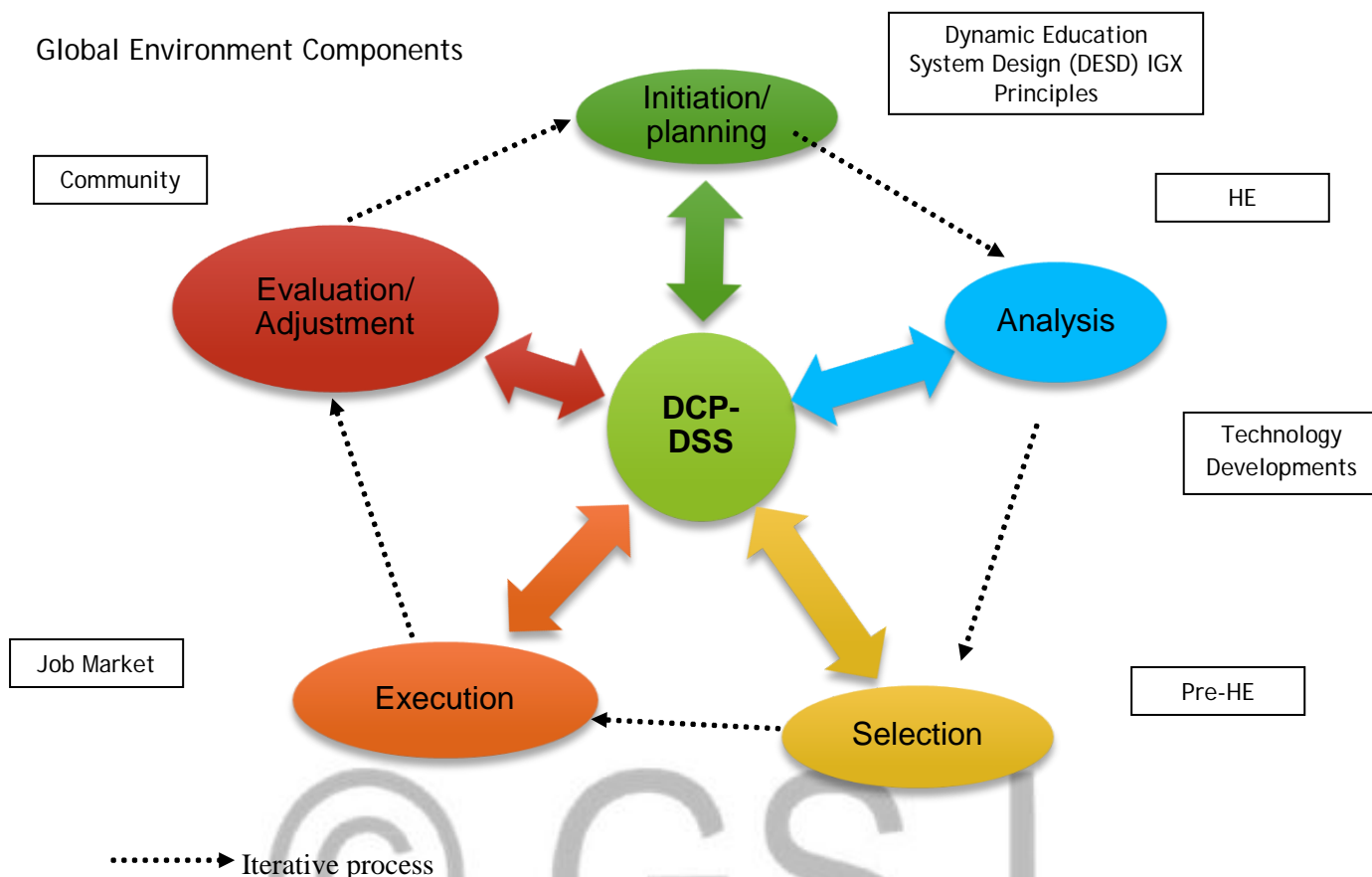
Further, some important criteria that should be sought when choosing an organisation are: matching personal preference, demanded by community/ business and stability and quality of the organisation. Other considerations to be sought when making career decisions are: Quality of primary/secondary education in terms of the development/non-development of a particular skill/s and/or interest/s; support/ non- support of family/community/government; stability of country political system; health/wellbeing /quality of life related issues and personal qualities/ IQ level.

Generally speaking, it is assumed that education programmes and education systems are designed for the increasingly different mix of learners with different variables such as: past experience, skills, age, abilities, culture, marriage status, gender, needs, part/full-time learning, part/full-time work, as well as individual and learning styles differences. Equally important, the need for effectively and efficiently preparing students for the future information era that is described as dynamic, agile, continuously changing and volatile. Education systems must also be compatible with industry and the advances in information communication technologies and cater for lifelong learning principles. On the other hand, essential steps/activities that should not be ignored are: Search and Investigation, for example: asking mentors, career services, internship, work experience.

6.2 *Dynamic career path decision support system (DCP-DSS) Model*

Dynamic career path decision making activities/ processes should logically start with the end result/ outcome in mind (Covey, 2013) and then work the way backward to achieve this result/outcome (Wiggins and McTighe, 2005; MindTools, 2016): Student gets help/support for planning the career path/ looking at the end (preferred/ possible suitable career) → Based on this student makes a choice of a relevant program/ field of study → Choosing a university → some universities accept/ decline → a university accepts → student graduates/ career services help finding a relevant and thoughtful job. It is also important here to take into consideration the micro environment effect (personal qualities, influences of family, friends, school, college, uni, immediate community, etc.) as well as the macro environment (e.g. influences of society as a whole, government, international elements, etc.). Therefore, it is vital to establish an elastic, dynamic and flexible decision making processes and phases that link to all stakeholders and dynamic/real-time information sources similar to the concept of 'Google Map'. The lifecycle should start with the initiation/ planning phase (the trigger/ Decision of taking a Career Path) → Career Analysis (identifying personal style/competencies/ what are the available/ possible choices? choice of program/s of study, choice of university, choice of field, choice of organisation/ own business) → career design/ selection (backward design/ start with the end in mind/ how the plan be executed/ selection) → execution (executing the design/selection made) → evaluation of progress and making adjustments to CP (if/when necessary).

Figure 7 Dynamic Career Path Decision Making (DCDM) Model- Career Path Life Cycle



The model takes into consideration elements such as: system thinking, decision making general processes; iterative development and progression, knowledge management concepts and principles, possible biases towards certain jobs and fields, uncertainties specific to different organisations, work environment, different management styles, work pressure, entrepreneurship / agile systems development way of thinking. the model takes into consideration essential concepts including (but not limited to): the Dynamic Education System Design (DESD) IG3-IGX Principles (Sabry and Barker, 2009) including the Pyramid Building Model, decision making models whether related directly or indirectly to CP (Bocij et al., 2019; Kent University, 2016; Robinson, 2016; Hoffman and Casnocha, 2012; Todd, 2017a) and the H-EMS Model (Abdelhakim and Sabry, 2009) including components such as the global environment components: pre- HE, HE, Community, job market, technology developments. The model stresses the need for a more cohesive, global, integrated form which may include the following iterative phases:

Analysis: the planning and analysis phase is considered a comprehensive activity, discovery stage and awareness of the type of decision to be made. It looks into/ identifies all possible alternatives and the most relevant ones. It examines and investigates alternatives and their implications, using tools such as career testing, personality type testing, searching, career counselling, narrowing down the career choices, etc.), spending time in the actual work environment of each choice. Investigation may include reading/research, consulting experts/practitioners, trying out/volunteering, etc. it is essential to help students in recognising their potential and opportunities through a comprehensive analysis of multiple factors. Self-awareness

(self-analysis including skills, values, interests and personality); Opportunity awareness (opportunities analysis);

Selection: the design/ selection decision making phase, ranking and making choices (investigating and researching in more detail each of the identified top career choices, including flexible plans A-Z (Hoffman and Casnocha, 2012; Todd, 2017a): A (top/ ideal option or best scenario), B (close options/ nearby scenario), Z (temporary fallback option). Selecting the most relevant ones and ranking them, in terms of impact, career capital, value, personal fit, satisfaction. Making the final big decision, the one first choice.

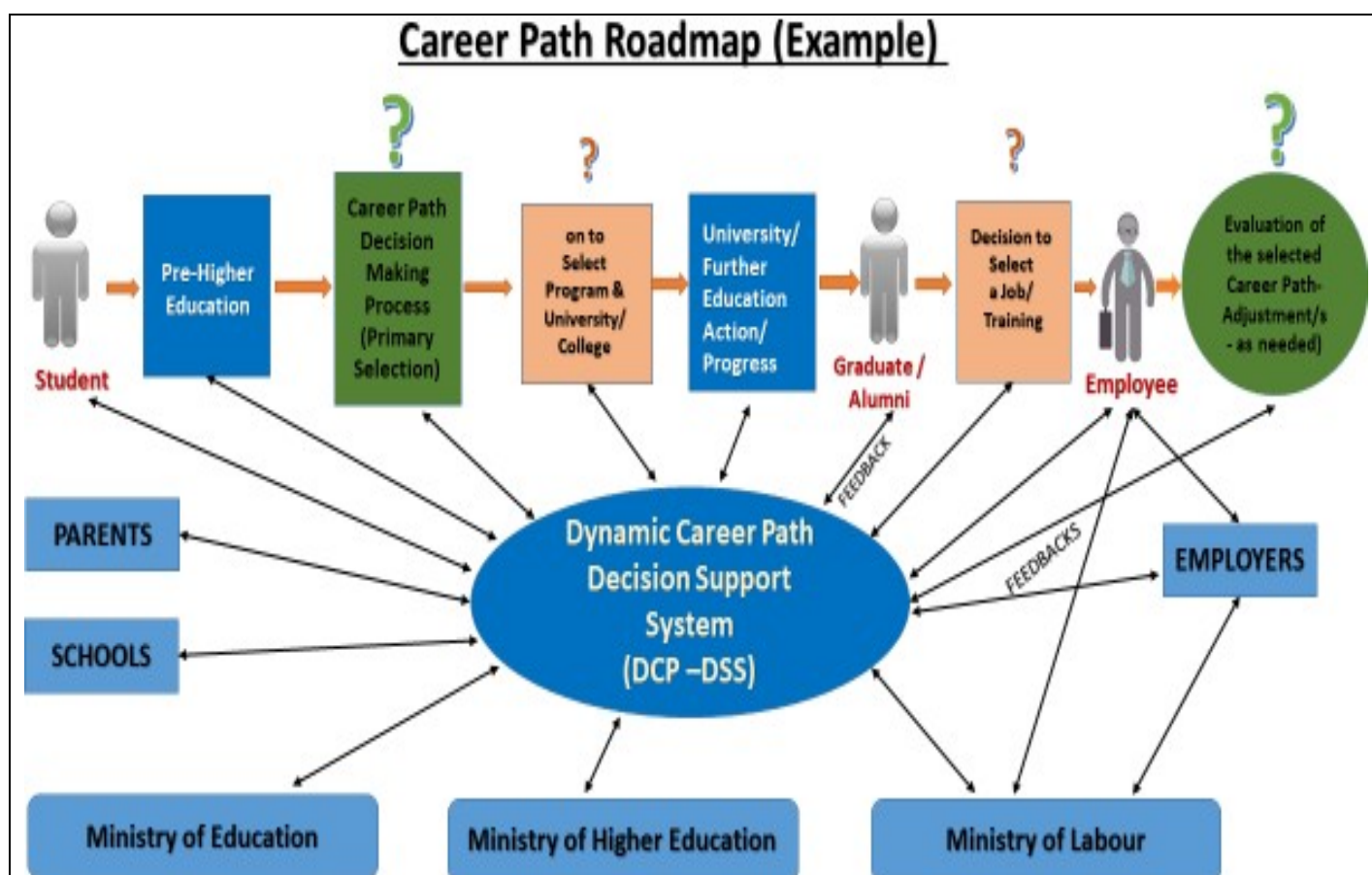
Execution: this phase implement the selected path, going ahead and implementing the selected/ chosen alternative. Taking action. Training and Education (going to school, taking classes, getting hands on experience); The Job Search (writing the CV, finding the right company), etc..

Evaluation/ Adjustment: maintaining, evaluating the effectiveness/ appropriateness of the decision. Setting check-in points to check whether or not on right track. If necessary, switching to plan B/ Z. The Ongoing Career Management (ongoing career maintenance, networking, building key relationships).

6.3 Career path roadmap example

The diagram below (figure 8) gives an example of a Career Path Roadmap, highlighting the 2 main selection processes (with question mark symbols), the first selection is identifying the career path that involves comprehensive analysis of different factors/ elements including (but not limited to) the student personal qualities/skills, preferences, labour market, opportunities, updated/ real-time information provided by stakeholders, etc. The decision to select a program, university or college are consequences of the first selection process (career path). The second selection process involves the continuous adjustment/ evaluation of the first selection with the necessary modification/s (if any). This is to emphasise that the Career path DSS is more than just selecting/ deciding on a university/ job, but a more comprehensive global system thinking design as depicted in the model and roadmap example.

Figure 8 Career path roadmap- an example



7 Conclusion

Determining an effective quality career path that is also efficient is not an easy task. It requires careful and full understanding of several interrelated and overlapping factors, considerable communication and research due its pivotal effect on the individual and society as a whole. This may impact on culture, society and politics through providing different means of communication, socialisation, business, knowledge capture and education. The review highlighted important elements such as: system thinking, iterative nature of processes, and other aspects as: Knowledge Management, Entrepreneurship, and agile systems development way of thinking. This paper highlighted and explored some essential career path processes and properties, reviewed some of the problems facing students and education management and proposed the Dynamic Career Path (DCP-DSS) Model and Career Path Life Cycle, a model that highlighted the interrelated activities and considerations involved in career path decision making that may inform the development of DCP-DSS, combining essential concepts including (but not limited to): the Dynamic Education System Design (DESD) IG3-IGX Principles (Sabry and Barker, 2009) and the H-EMS Model (Abdelhakim and Sabry, 2009).

The paper further provided an illustration of an example of a career path roadmap linked to information providers and stakeholders. Current environment require flexible, but concise designs, helping students to know what they actually want, what they are actually good at, and what is possible and what is not possible, what is practical and what is not, what is visible and what is not, etc.. There is a continuous and pressing need for new ways of thinking about the whole education system, including both the learning and administration components. Using a system for students' guidance, similar to the 'Google Map' concept, to choose the most appropriate career path that is suitable for them and consequently the appropriate program/s of study; students' guidance to choose the most suitable education institution/s to achieve their goals and guidance for choosing the job that fits their attributes and needs. It is a cycle that may need monitoring, evaluation and some adjustments along the way. Students, on the other hand, should not only be given information, but more importantly be taught to be independent, search, research, communicate, innovate, create and consequently benefit their communities and society as a whole. This will help in fulfilling their ambition and achieve happiness. One method of overcoming the uncertainty surrounding one's choice of program of study and or career path is for each university to provide a tester program whether online or face to face that actually take students through the main elements/topics/ contents and global view of the program to help them make a more informed decision whether they should or should not pursue a career in such area/field. This review as well as proposing the Dynamic Career Path Decision Support System (DCP-DSS) Model and the Roadmap Example, it was an attempt towards more understanding of complex, interrelated and overlapping aspects and factors that compose career path decision making process. It sought to highlight certain aspects that may lead to improvements in the design of education systems towards more dynamic and viable systems.

Further, research is needed to examine the proposed model and contribute to its development towards establishing a global framework that links all stakeholders and sources of information and finance to best support students and education institutions in a global scale. The paper highlighted directly and indirectly many possible areas that need investigation, including the potential of cloud computing and IoT for the implementation of an integrated student portfolio that aims to follow the student through all levels education and employment. Future work should also look at issues such as for example: the integration of information related to management styles, work environment aspects, specialised information related to different work areas/fields, society/ culture related circumstances, jobs roles specifications/ description, biases towards certain jobs, fields, verities/ uncertainties specific to different organisations, work environment, different management styles and work related pressure. Finally, it is important to mention that, starting the CP processes as early as possible, starting from school level can minimise many of the problems students may face when reaching the university level education.

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