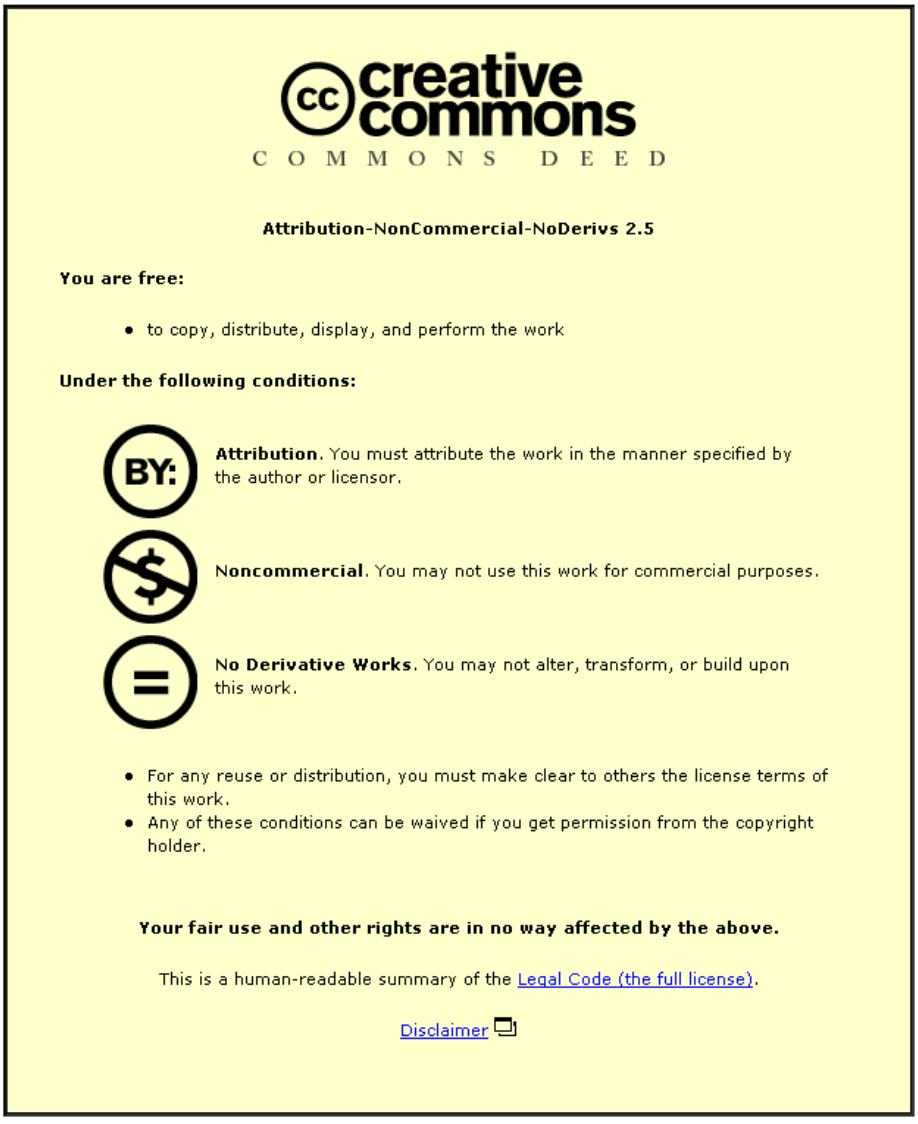

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WORKFORCE DEMOGRAPHICS, CHALLENGES AND STRATEGIES; A 'DESIGN FOR ALL' METHOD IN A MANUFACTURING INDUSTRY PERSPECTIVE

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ABSTRACT

The workforce is ageing rapidly in most parts of the world. Today's challenging and economically competitive working scenarios demand the retention of skilled, experienced and more loyal older workers. Ageing affects work performance and it becomes necessary to understand the effects of ageing. However, there are many negative stereotypes which result in discrimination in relation to older workers. A 'design for all' method is considered helpful in the promotion of the employment of older workers where products, service and workstation design requirements of older workers might be addressed proactively. This approach uses realistic data about physical, physiological and cognitive abilities of a variety of people who belong to different age groups, shapes and sizes. Implementation of this strategy can potentially ensure better and safer working environments for all workers. This paper reveals the need to use this computer-aided design for all methodology for industrial applications, especially assembly activities in the manufacturing environment.

1 INTRODUCTION

The global workforce is ageing rapidly. It is estimated that one out of 5 persons will be of age 60 years or above by 2050 and this will ultimately increase the dependency ratio (the proportion of economically inactive versus active population) (U.N.O.). Moreover, the median age of the population is increasing in almost all parts of the world. Figure 1 shows this trend where it is clear that the median age of the world population will increase by 34.5% (to 37.8 years) between 2005 and 2050; and the same trend will be followed in most parts of the world.

Like many other countries, the UK population is also ageing but due to higher birth rate, it is less alarming as compared to other European countries. In 2009, the proportion of the UK population over 65 years was 16% and this shows only a slight increase when compared with 1985, when the figure was 15%. In 2008, Japan was the most aged country in the world and 22% of the population was aged 65 and over (O.N.S. 2010). In the light of current statistics, it becomes important to utilize older people in a better way so that they might contribute to the national and global economy. Retention of older workers for a longer time seems a good solution to this ageing workforce problem.

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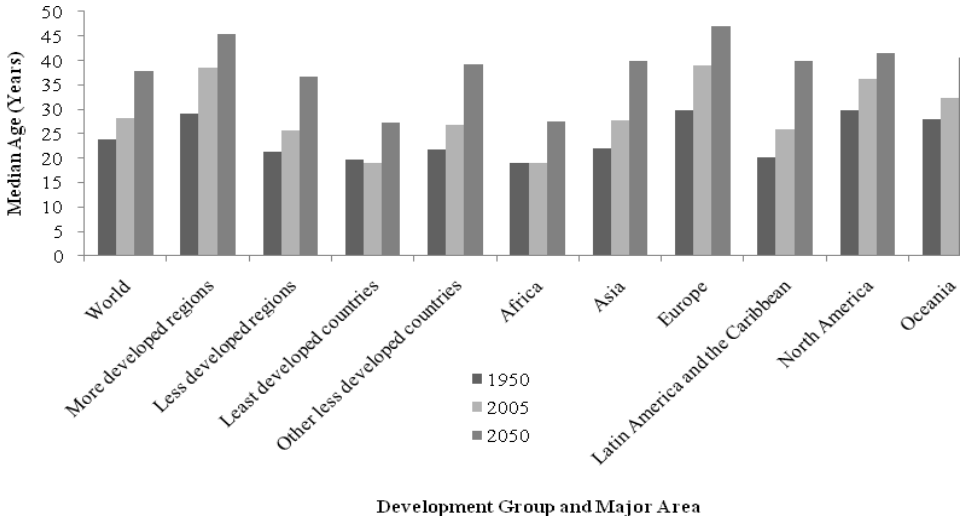

Figure 1: Median age of the population by development group, 1950, 2005 and 2050 (U.N.O.)

2 CHALLENGES AND NEGATIVE STEREOTYPES

The removal of an experienced and skillful older worker is not simply the loss of one person; it is also a drainage of skills, knowledge, experience and relationships and to regain these attributes needs resources in the form of money and time (Dychtwald 2004). Ageing causes a decrease in functional capacities. including physical, physiological or cognitive which ultimately affects work performance negatively. Musculoskeletal strength starts decreasing after the age of 30 years. There is a significant difference in muscular strength between a 30 year-old person and a 60 year-old, and this directly determines work capacity (Wanger 1994). Balance disorders are very prominent in older people and are a major cause of slips, falls and injuries. Moreover, these disorders and risks of falls and injuries lead to a decline in work performance in sitting, standing, walking and leaning postures (Sturnieks 2008). Flexibility also decreases and is a cause of falls and injuries. Joint mobility decline is also evident in older people; however, it's severity depends on the particular joint and type of motion (Chung 2009; Chiacchiero 2010).

Today's highly automated environments demand a quick response from workers, whereas reaction time and speed of performing a task are negatively affected by age. It is well documented that reaction time for older workers is greater than that of younger ones (Falkenstein 2006). Moreover, reaction time variability becomes more prominent among older workers and this inconsistency leads to a complexity in decision-making (Hultsch 2002). Aerobic capacity directly influences a worker's capacity to do the work. It is very clear from the literature that older people are less able to accommodate variations in job demands as the decline in maximal heart rate adversely affects aerobic capacity (Boyce 2008). There are many other factors like thermoregulation, learning capacity, memory deterioration and feeling of fatigue which are more prominent for older workers and these are challenging to designers. A list of prominent changes that occur with ageing is shown in Figure 2. In the light of the above discussion, it can be concluded that it is very important to understand all the changes that come with age and how these can be addressed in the design process.

Where there is a need to retain older employees in the workforce for a longer time, there are many age stereotypes that act as barriers to their employment and retention. It is evident that younger applicants are considered more positively as compared to older ones (Gordon 2004). There is a need to understand and address these stereotypes as these discourage and frustrate older workers from remaining in the workforce (Brooke 2005). There are many common stereotypes mentioned in the literature; like poor performance, resistance to change, lower ability to learn, shorter job tenure, more costly and more dependable etc (shown in Figure 2). Studies also show that there is a weak correlation between these stereotypes and age. However, performance often improves with age as workers get more experience and skill (Posthuma

2009). Warren (2001) compared how age stereotypes are related to discriminatory attitudes at work between UK and Hong Kong. It was found that UK workers are more effective at work but less adaptable to change as compared to Hong Kong people. Moreover, stereotypical beliefs have influence over respondent's perception about the effects of training, promotion and retention of older workers. Not only organizational but socio-political culture also affects behavior towards older workforce (Warren 2001).

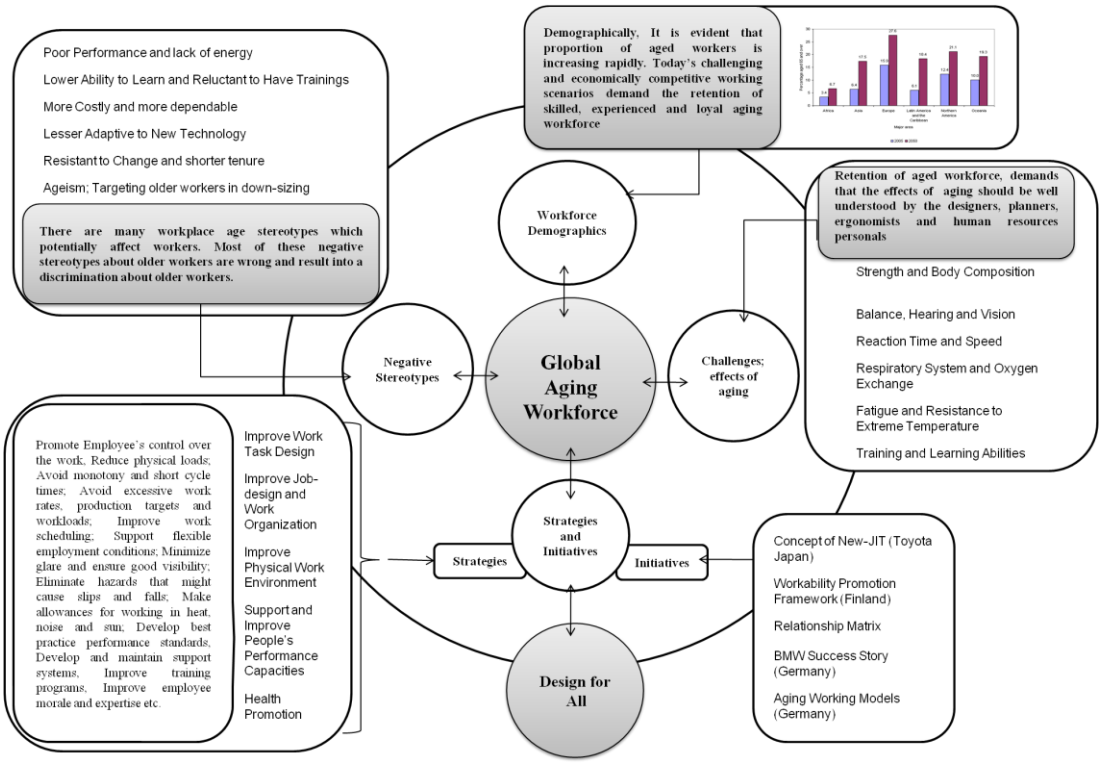

Figure 2: Global ageing workforce; demographics, challenges, stereotypes and strategies

The above discussion shows that ageing adversely affects work performance of older workers; however, there are many negative stereotypes that act as a barrier to the employment of older people. There is a need to establish a method that can realistically address the needs of older workers. Older workers can only be productive and useful if designers, planners, ergonomists and managers ensure safe and healthy working environments for them, where they can perform tasks according to their natural work capacities.

3 INITIATIVES AND STRATEGIES

In the 1980s, the term *work ability* was first time used in Finland. The objective was to answer the question: "how good is the worker at present and in the near future, and how able is he/she to do his/her job with respect to work demands, health and mental resources?" (Ilmarinen 1992). The concept of work ability is a complex and multi dimensional issue where the main objectives of work ability assessment are: identification of decline in work ability; effectiveness assessment of preventive measures and assessment of work disability. A feasible method of work ability assessment, Work Ability Index (WAI), was constructed which takes the aspects like functional capacities, job demands, health and other aspects into consideration. Many studies were conducted where it was concluded that the mean value of the work ability index was significantly reduced for active workers aged more than 51 years. It was further summarized that physical work load and age are critical factors which influence work ability of older workers (Ilmarinen 1997). High physical demands, stressful and dangerous working environments and poor organization of work are the key factors that cause deterioration of work ability of older workers (Ilmarinen

1991). The Finnish Institute of Occupational Health (FIOH) designed action programs in 1990-1996, where the objective was to promote work ability of ageing workers based on these findings. The basic concept was based on four actions: (i) adjustments in the physical work environment, (ii) adjustments in the psychosocial environment, (iii) health and life-style promotion and (iv) updating professional skills and knowledge. Figure 3 shows a concept diagram of this program (Ilmarinen 1999). Later, it was emphasized that work ability of an individual is a process of human resources in relation to work (Ilmarinen 2001). It was further emphasized that the concept of work ability is a dynamic process which changes throughout one's work life, however the main factor is ageing that affects human performance. Human resources can be described by: health and functional capacities (physical, mental and social); education and competence; values and attitudes and motivation. Work ability is found by relating all these comprehensive individual factors with work demands, work management and work environment. This new concept is well described in figure 3.

Moreover, the literature identifies a list of strategies (Figure 2) that might be useful for the improvement in productivity of older workers. Improvements in work task design, work organization, physical work environment, and improvements in peoples' performance capacities might lead to productive and safe working environments for all workers and specifically for older ones.

Currently, many organizations have taken initiatives to promote retention of their older workforce. Toyota introduced a concept of 'New JIT' to address the needs of 21st century customers. The optimized use of the older workforce was identified as being very important in a continuously changing market. Along with many other strategies, they also launched an 'ageing and work development' project to promote strategies for the ageing workforce. It was found that strategies like motivation, reduction in physical strength, redesign of tools and equipment and control of suitable temperature conditions were very

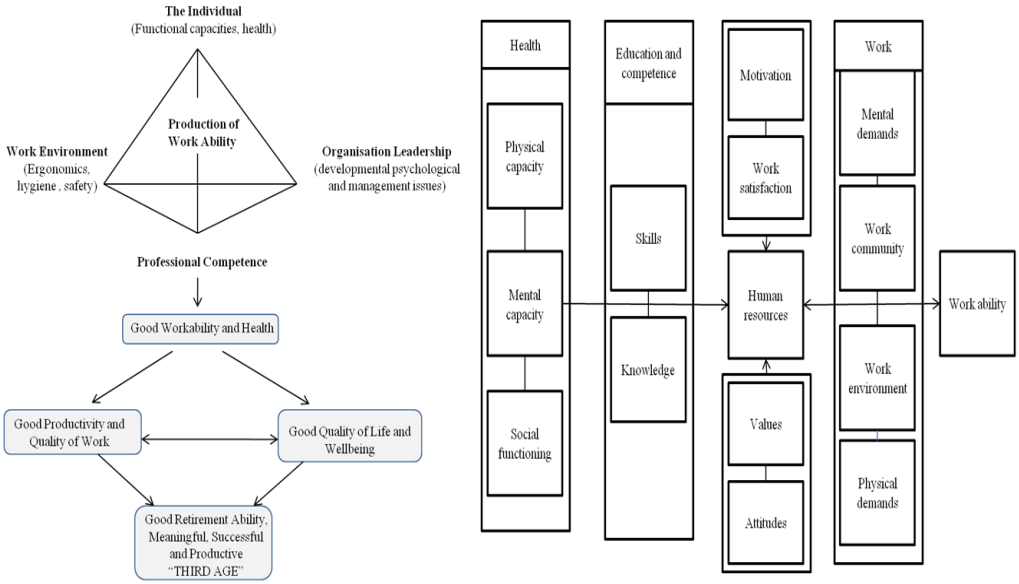

Figure 3: Concept of promotion of work ability during ageing (Ilmarinen 1999; Ilmarinen 2001)

useful for older workers and the strategies were implemented in local and overseas plants. It was also concluded that manufacturers have to shift from work-oriented to people-oriented shop designs, especially for assembly workers where job demands are relatively high (Amasaka 2002; Amasaka 2007). BMW has taken up the issue of the ageing workforce and figured out how it can make its workplaces easier, more comfortable and more efficient for older workers. They simply analyzed the behavior of assembly line workers and made very simple modifications like wooden floors, fitting of unique chairs on the assembly lines, ergonomically designed tools and computer monitors. Surprisingly, productivity went up seven percent, attendance increased and the assembly line's defect rate dropped to zero (BMW 2010).

4 A DESIGN FOR ALL APPROACH IN ASSEMBLY ACTIVITIES

The above discussion reveals the need for an approach that can address the design needs of the older workforce. A 'design for all' approach seems appropriate, as it aims to address the design needs of people with disabilities and older people. Previously, a 'design for all' tool called HADRIAN was developed

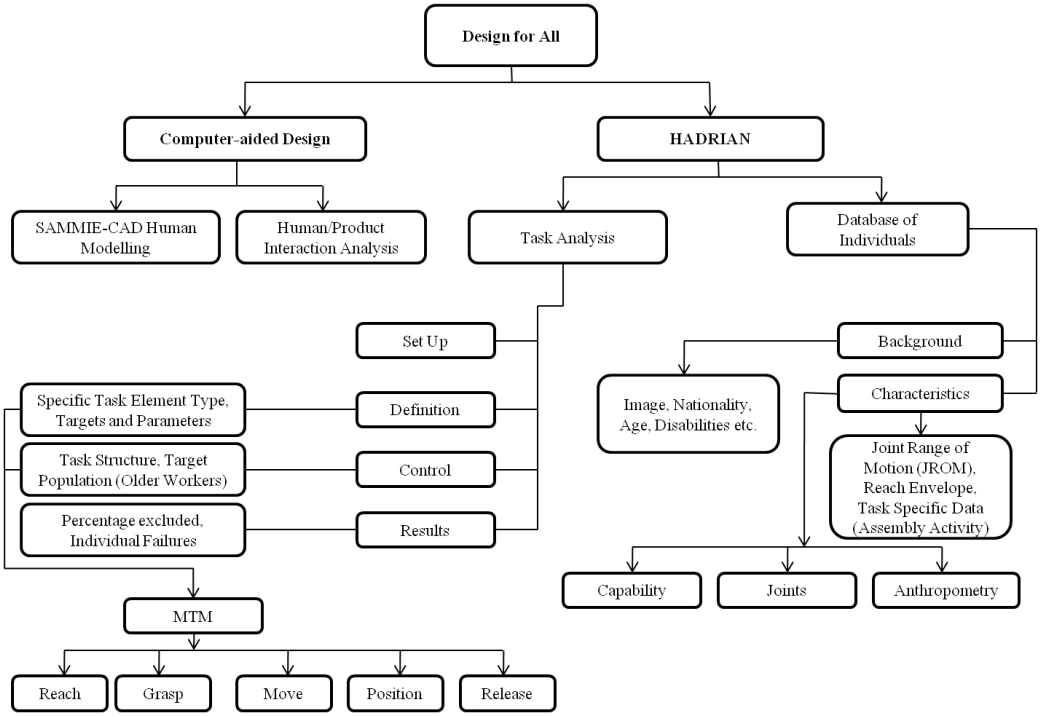

Figure 4: Schematic diagram of using a 'design for all' method in manufacturing industry

which is based on SAMMIE, a digital human modeling (DHM) system where information about people with different anthropometry, functional capacities and ages is utilized to assess the suitability of any design. This DHM approach has successfully been used for domestic and transport environments to assess where the percentage of the population accommodated against any design scenario. Current research is focusing on industrial applications, especially manufacturing assembly activities where the suitability of any workspace design will be accessed for older workers. A schematic diagram of this design for all approach is shown in the Figure 4; it shows that an assembly activity can be divided into its fundamental motions like reach, grasp, move, position and release. Finally, data about a specific task can be utilized in the digital human modeling tool from which design recommendations for older workers might be drawn.

5 CONCLUSION

The global workforce is ageing rapidly. It is predicted that there will eventually be a labour shortage problem in most developed countries. The retention of older, skilled and experienced workers for a longer time is important; however, ageing creates a number of challenges in the form of a decline in the capacity to do the work. Moreover, there are many negative stereotypes about older workers that act as a source of discouragement for the workers. A 'design for all' approach can potentially be utilized to understand and address the needs of older workers. The HADRIAN methodology will be used to construct workplace design recommendations for older workers, especially in assembly activities. Future research will be focused on the inclusion of assembly-based task elements and their utilization in producing design recommendations for older workers, potentially leading to safer and more productive working environments.

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