Need for Survival in "Genomic Market Economy": Attracting Foreign Investments and Saving Country's Economy By Adapting Molecular Pathology Diagnosti in Pakistan

The complexity and cost of baseline laboratory analytics will soon to be challenged by next-generational and innovative biotechnological developments in the field of pathological sciences. The once idealized "Lab on chip & MRI on hand" is just shaping away reality thus superseding human resource, conventional laboratory biotechnology, business yield with projected undesirable as the demise of traditional laboratory.[1] Though the rise and fall of medical specialties can be easily predicted to combat the deep-down intricacies of human pathology, still shall challenge pathologist's innovative quotient for survival in the fast-tracked "market economy". Fearsome remain the ideation of pathologist and technologist losing jobs alongwith other healthcare professionals thus a professional meltdown is expected sooner than expectations.[2] Adding further to professional way forward will be the new "introductions in pathology" which shall find nurseries in developed nations thus taking our economy further away. towards biotechnologically superior labs. Thus, new innovations in labs as being introduced or under various stages of R&D shall be the "Strategy" are to become mandatory for laboratorians to adopt or develop to remain pertinent in this fast-growing competitive laboratory economy.

Where there are bigger challenges, the "Human kind" has always displayed the mightier sense and emerged as stronger planetary species. The authors of this viewpoint/editorial have faith to believe that lab science can take on this not so unprecedented challenge to bridge bench to clinic gap with fast-tracked and well-potentiated innovations in pathological sphere.[3] Molecular pathology for conventional specialties stays a must alongwith cytogenetics and especially opportune us to take at least regional lead in genome editing, metabolic 3-D organoid development, biobanking, CRISPR methodologies and specialty specified services.[4] The pathology vision starting from manual microscopy to ELISA now demands a real phenotype to genotype" transformation with single-point genetic diagnosis and precision pharmacogenomics. We also believe futuristic bioscience, the surfacing bioinformatic, genomic medicine, molecular pathology and cytogenetics need innovative sequencing platforms and ultra-paced diagnostic exploration. Likewise, the conventionalism in virology and microbiology needs realignment towards single-point diagnostic via new constructive designs incorporating upgraded biological safety levels to not just preempt epidemics by regular surveillance but also to knock-down the epidemics with better tools for vigilance, predicting lethality and timely pathway for cure management.[5] Need not mention the conventional methodologies here will be redefined to next-generational requirements.

We specifically intend to highlight our agenda write up to persuade the most concerning but much needed aspect of healthcare i.e., economy of care. While we mentioned the newer diagnostics in ease and pace, we believe the any Rupee spent on care will emerge as the most concerning factor for the "Clinical Leadership.[6] We not need to manage the ongoing population boom and thus require not only a very broad spectrum professional policy towards diagnostic services in Pakistan but also the need of the time and trained human resource to convert the need into opportunity into our strength. This can only be done by being a visionary perception of future lab-related modifications and then to utilize our main punch i.e., lower "purchasing power parity" to develop lab arsenal in house quality biotechnology developments.[7] Clinical laboratories must ensure to target high volume low complexity testing like newer varieties of PCRs, isothermal amplifications, microarrays alongwith different types of sequencing methodologies with minimal support services.

Need not to highlight this global level molecular plight which till remains preliminary and take-off flight mode, which should lead us to evolving genome editing methodologies, synthetic genomics, cell line, 3-D organoids and much more. Our country replicating these primary efforts can emerge with novel marketing via both public and private sector with collaborative efforts can rise in this science and economy. Regular nation-wide expert agenda focused meetings along with providers and manufacturers can help allow timely incorporation of such ideas into practice. After an initial catch-up phase we believe we can be self-reliant under the umbrella of organizational oversight muscled by regulatory compliance. While seem threatening the ideation of AI to machine learning and the recent innovative entries in pathology, the flip side of coin seems more

encouraging once we develop the baseline to dexterous technologies for various kinds of sequencing with optimized contracts we believe Pakistan can emerge as a hub for "Genomic Economy" where vacuum, low-cost labor and well-qualified laboratory leadership alongwith biotechnology and bioinformatics.[8] Once we use the terminology of "Genomic Economy" the idea behind is to associate economic gain or loss linked to the planned usage of molecular genetics in the context of economy. Similarly, "Geoeconomics" is also coined to express that most economic indicators are related to some genetic basis which can determine the financial behavior of an individual. While "Genomic economy" is currently hard to meet with current level of awareness and fear of failures, still data is evolving to capture the associated financial and healthcare benefits from optimized economical benefit for individuals and regional growth.[9] Current data suggests that global genomic market can exceed beyond 30Bn in just 5 years. Incorporating agriculture, biotechnology, drug discovery and use for living beings with current 46 Bn is anticipated to rise annually by more than 2Bn and beyond to finally overtake multiple bioscience and biotechnology markets. The cost estimates though difficult to measure in totality still relates to data mining, disease predisposition, predictive medicine, diagnosis of rare disease, drug discovery to development, pharmacogenetics, genome editing, human-microbe intera-ctions, metagenomics, and possibly other related subjects. All these areas are booming and utmost needed for growing human population health, care of environment and managing quantum with quality of food chain.[10]

Unfortunately, or fortunately, "Medical Service Provision" dynamics no matter what, will stay dependent on the "laboratory" perhaps with new arsenals. Future pathologists and clinical care domains will be needing next-generational higher complexity diagnostic tools, pharmacogenomics and defining some of the newer lab entrants in clinical arena like organoid to mini-organ development, biobanking and being predictive enough to prempt disease in the budding. Genome editing methodologies including CRISPR, Base and prime editing can also help revolutionize concept to practice of symptom-specific to curative gene targets in real-time. Labs with collaborative AI and machine learning inputs can bury the upgrade syndromic medicine to predictive, gene-level defects, preempt personalized therapeutics and most importantly can root out for any congenital and hereditary defects of nature. The authors therefore assume that today's utter oblivion incoming genomic revolution in genomic science if incorporated in real-time in near-exactness can bring home a lot of revenue or else this could be another drain we need to clog at some time due to revenue lost to alien industries outside Pakistan. So, opportunity is currently knocking at the door. Follow-up articles are needed to mature this "preliminary" effort to raise voice in terms of achieving maximum from "Genomic Economy". Realization for change MUST lead to "functional task groups" incorporating genomic subject experts, financial managers, biotechnologist, IT/AI members and people who deal with policy making.

Declarations

The author of this Need for survival in "Genomic Market Economy": Attracting foreign investments and saving country's economy by adapting molecular pathology diagnostics in Pakistan

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