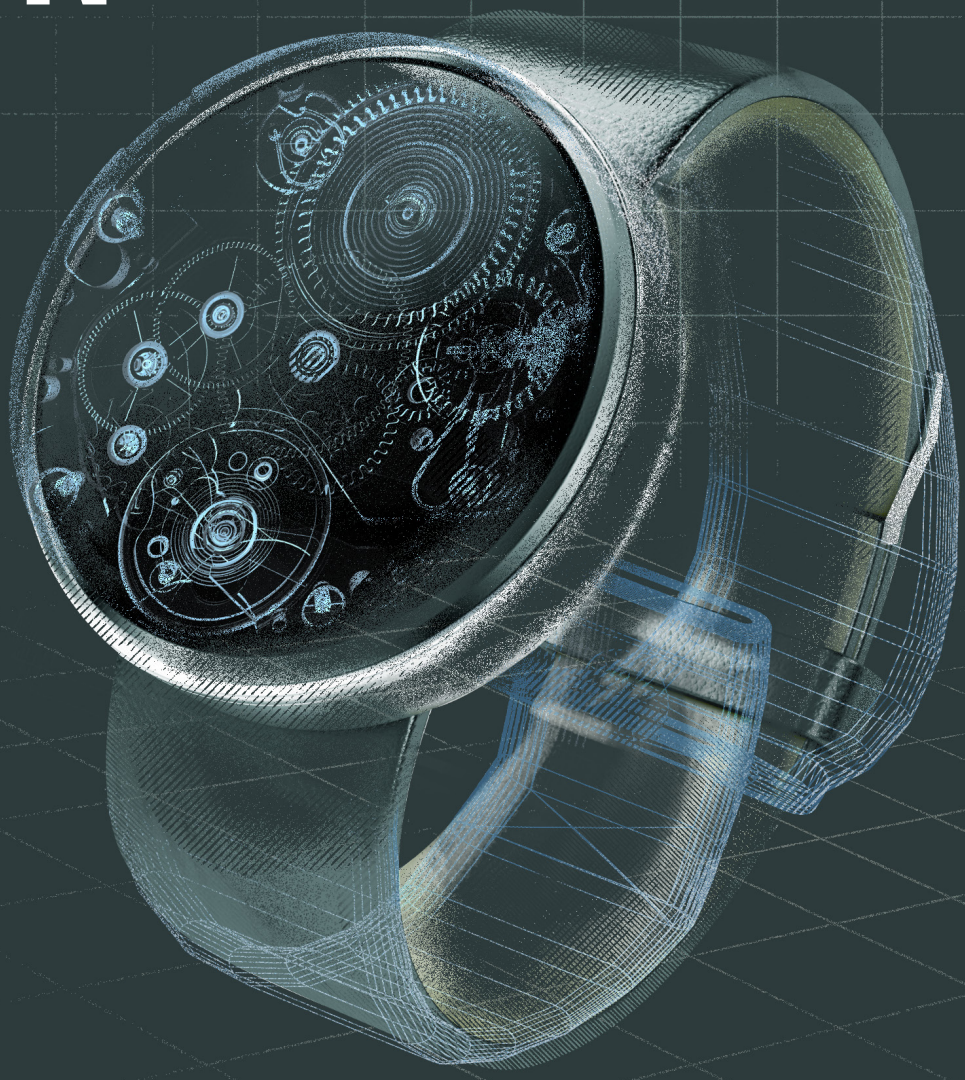
STARTING STRONG WITH PRODUCT DESIGN

Tech Expert insights on product framing and prototyping



IPI SINGAPORE
Innovation Partner for Impact

White Paper

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IPI catalyses and enables enterprises to grow their businesses through technology and innovation. A subsidiary of Enterprise Singapore, IPI promotes open innovation, and works with enterprises to source for technologies locally and abroad. In addition, it facilitates technology partnerships to bring new and innovative products and services to the market.

Connected to a global network of technology partners, technical experts and innovation advisors, IPI is well-positioned to facilitate connections between technology seekers and providers, driving growth and innovation opportunities for Singapore enterprises.

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IPI Tech Experts provide advisory and support to enterprises that are looking for technical expertise to enhance or complement their in-house capabilities. Businesses can tap into a pool of pre-vetted experienced experts with deep domain knowledge across different sectors and engage them to solve technical challenges that are encountered in various stages of their product development journey.

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CONTENTS

INTRODUCTION

A well-designed product can improve your quality of life, but when design is thoughtfully implemented across different industries it can generate value for the entire economy. Everything from household equipment to medical therapies and even smartphone applications all start from the same place: they must first be designed.

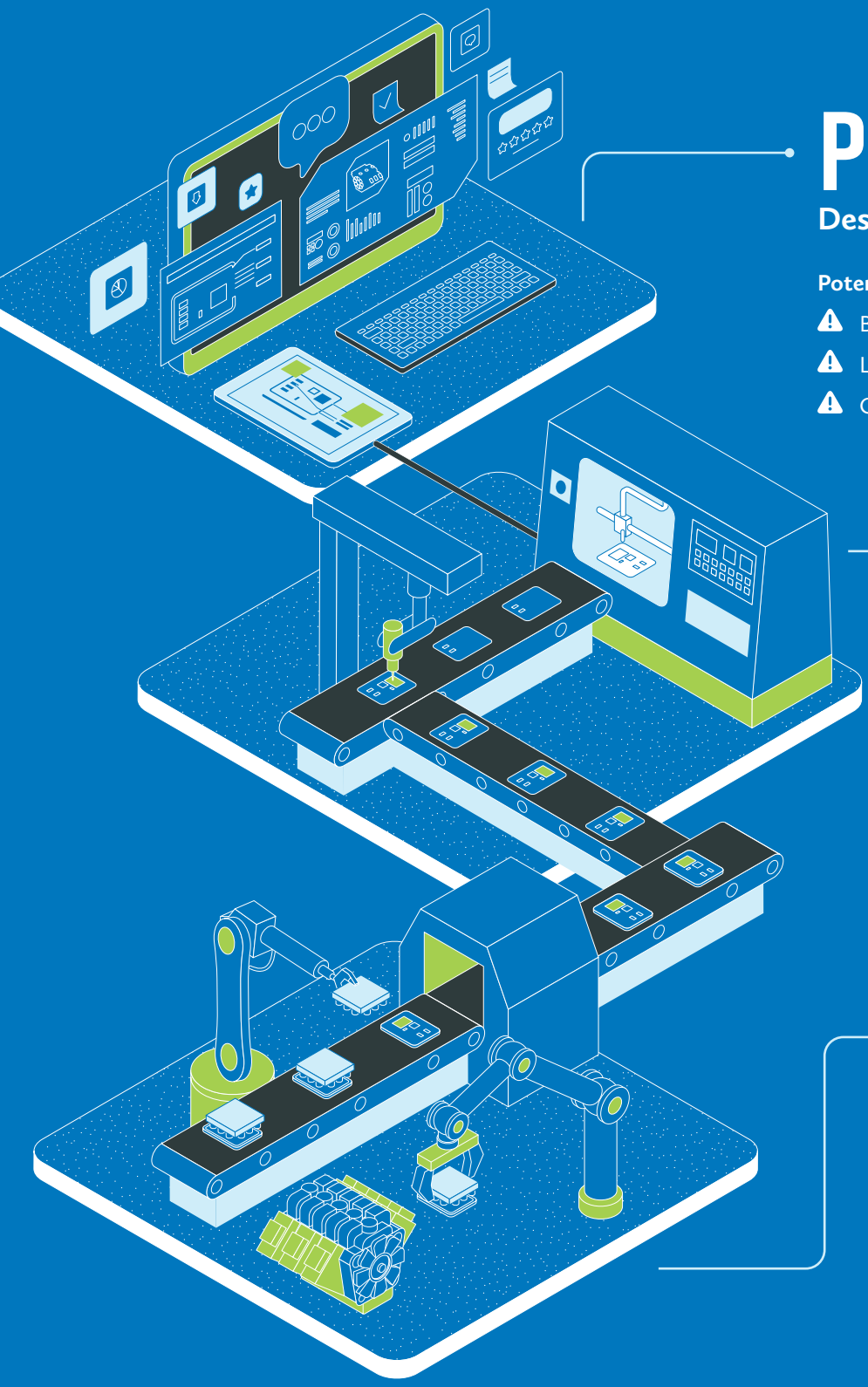
Design is the first step towards realising a product that can fill a niche or solve a need in the intended market. Design is not an afterthought but a crucial stage that informs the rest of the product development process. But the process of product design—from ideation to manufacture and commercialisation—is an intricate one that can vary from product to product. As a result, companies may find themselves faced with numerous critical variables that can affect the smooth transition from concept to manufacturing.

Most of these variables will make themselves known in the early stages of design and development. For example, without adequate framing before the design stage, the final product may not sufficiently address consumer needs. Such consideration is also required in the prototyping stage to ensure that the designed prototype can be translated into the final product. Further complicating the process is the fact that without sufficient experience and expertise in product design, it can be hard to foresee what problems will arise until they do.

The key to avoid these problems and ensure successful development lies in thorough consideration during the product framing and prototyping stages. Getting these two stages right will set the development process off right, reducing the likelihood of costly pitfalls and complications down the line.

In this white paper, IPI has gathered insights from two experts in the field of product design. Jeremy Sun, design director of design consultancy Orcadesign offers insights and advice into the importance of incorporating proper product framing into the design process, while Garrick Soon, director of manufacturing solutions company Protoking, shares his experience in product prototyping and manufacturing, and how to ensure a smooth transition between three-dimensional (3D) printed prototypes and final production.

THE THREE P'S OF PRODUCT DESIGN



PRODUCT FRAMING

Designing with end-users in mind

Potential problems

- Blind spots within the team
- Late product framing
- Changes to original intent

PROTOTYPING

Checking for function, fit and performance

Potential problems

- Prototypes not feasible to manufacture
- Material and other limitations
- Lack of understanding of manufacturing requirements

PRODUCTION

Mass production of verified product

PRODUCT FRAMING: WHY SHOULD THIS PRODUCT EXIST?

While the process of designing a product can be complex, the end goal is simple: create successful products that meet the needs and aspirations of consumers. Having this objective as a guiding principle will shape how you approach the process, said Jeremy Sun, design director of Orcadesign Consultants.

Product framing is the first step in the development of any product and should take place even before the design stage begins, he continued. While product design tries to define the 'what' of a product, product framing is a question of 'why.'

Framing a product requires contextualising its purpose and intent so the development team is able to move towards the right design directions and create a relevant and successful product. By understanding what matters to the target audience, framing can ensure the designed product will be relevant and desirable. On the other hand, if a product is not framed well, it may not stand out or worse, fail to be relevant.

Three hurdles in the way of good product framing

Despite the importance of proper framing, it is not always prioritised in practice. In the early stages of development, some project teams may focus primarily on features or technology first instead of product framing. According to Sun, this lack of priority may stem from three reasons.

First, teams may mistakenly believe that they have sufficient knowledge within the team to frame well. "If you don't know what you don't know, you won't look for the answers," Sun said.

Secondly, some project teams may recognise the importance of framing, but delay it in the hopes that good design work will be sufficient to shape the product. However, leaving framing too late can diminish its impact. In fact, the best time to product frame is in the early phase of product design and development, before the user experience, product archetype, functions, features and specifications have been defined, Sun says.

Finally, there may be a general lack of receptiveness to the findings revealed by the framing process, especially if it requires reviewing the original design intent. To illustrate this point, Sun describes a project that he worked on involving a product designed to incorporate Internet of Things (IoT) technology.

The initial aim of this product was to replace specific scheduled manual work and thus lighten the workload of healthcare personnel. To verify the framing of this intent, the project team conducted field research including observations and interviews to better understand the needs of the users and to validate the initially defined product functions and features. Through this fact-finding mission, the team found that rather than replacing the manual work, the product would end up disrupting the schedules of the healthcare personnel. As such, the product had to be reframed to focus instead on providing the users with meaningful information to empower them to make better decisions and be more efficient.

This is an example of how the original intent of a product may not translate when put in practice, said Sun. Proper framing and preliminary research prevented wasted effort and helped to put the product back on the right track.

Best practices for the best design

Drawing upon his years of experience in product design, Sun has identified some best practices and insights on how to frame your product correctly. First of all, get the sequence right: product framing should come before product positioning. Although it is tempting to begin by comparing yourself to what is already available in the market, without product framing, product positioning is merely an assumption, Sun said.

In fact, one key trend that he has observed is that companies are being put out of business by their indirect rather than direct competitors. For example, it is not rival camera companies that the likes of Nikon and Canon have to be most concerned about,

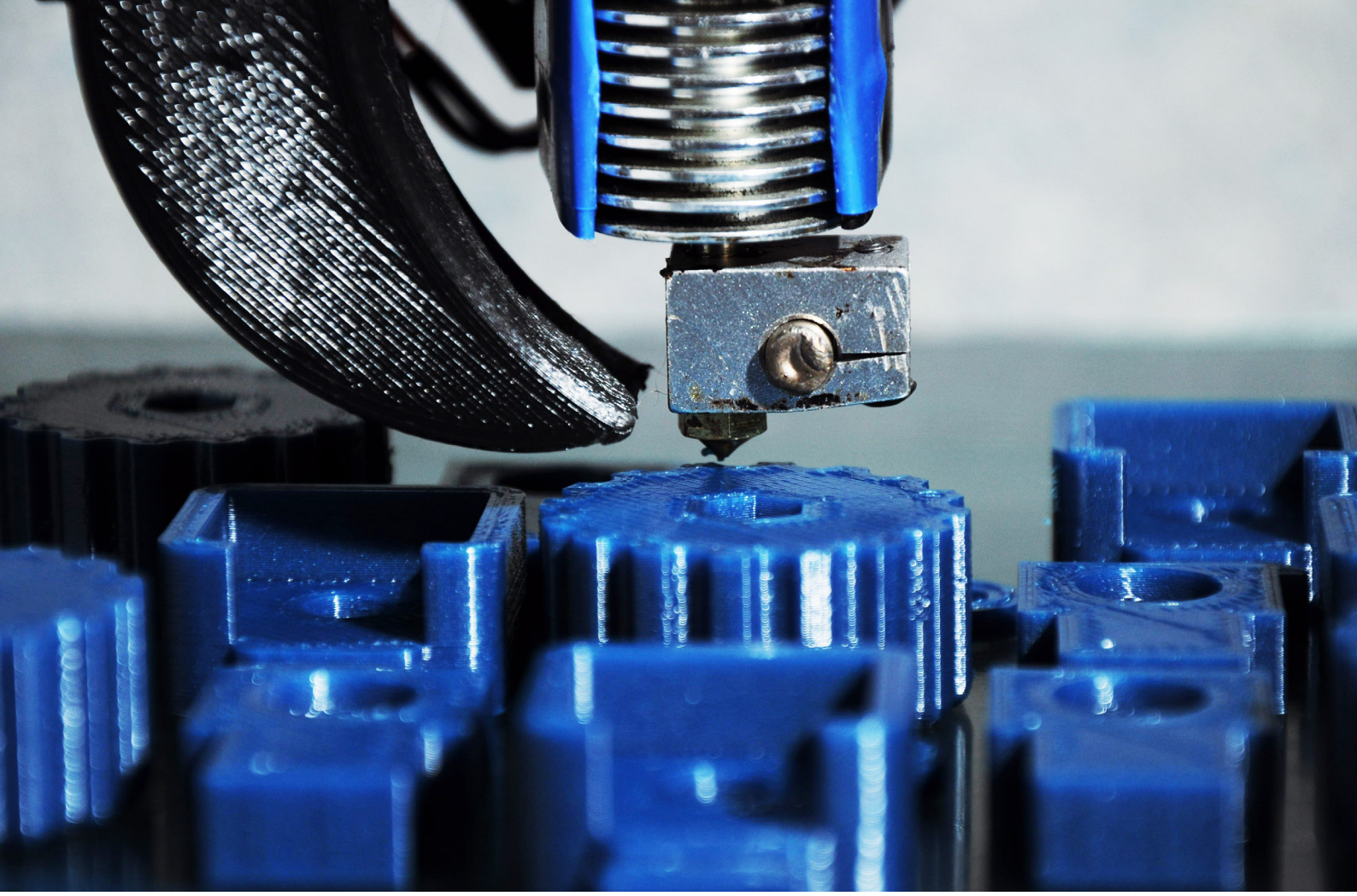
but mobile phones equipped with high-end lenses and cameras, Sun pointed out. “Companies are being disrupted not because they are incompetent but because they are out of touch with what consumers want,” he added.

One of the best ways to address the needs of the end user is to frame your product from varying angles, exploring and verifying each of them before making your decision. For this step, reach out to both specialists and generalists, combining their perspectives for the best of both worlds, Sun advised.

“Your team are the domain experts, whereas designers are the methodology experts,” Sun said. “While both are important, don’t mix them up and set the wrong expectations.”

Product framing is a complicated task and it is crucial that it be done right to set the rest of the development process and the final product on the right track. Working with a Tech Expert like Sun, with a wealth of experience in product framing and design, can ensure that your product development starts off on the right foot. Design consultancies like Orcadesign can help with the product framing stage by offering research into customer insights and providing user-centred design and development. Get the most out of working with such experts by involving them early, utilising their mindsets and leveraging their multidisciplinary skills.

IF YOU DON’T KNOW WHAT YOU DON’T KNOW, YOU WON’T LOOK FOR THE ANSWERS.



THE VALLEY OF DEATH: FROM DESIGN TO PROTOTYPE

No matter how good a product design looks on paper, the proof is in the pudding, or in this case, prototype. When products make the transition from idea to reality, numerous constraints quickly come into play, from cost to feasibility and other practical concerns.

Although prototyping methods like 3D printing promise to reduce the gap between imagination and actualisation, they are not without their own limitations too, said Garrick Soon, director of manufacturing solutions company Protoking.

Although part of the same pipeline, design and manufacturing are different processes, with different limits and operations, Soon explained. Protoking aims to help companies cross the 'valley of death' between design and manufacturing, particularly in the transition from prototyping to manufacturing.

Printing with purpose

A good example of this is how Soon is bridging the gap between 3D printing—now frequently used for prototyping—and more conventional manufacturing methods. Prototypes are traditionally built by hand using materials such as blue polystyrene foam, composite wood or ABS plastic. These materials, as well as the manual nature of the process, allowed designers flexibility but also made prototype construction costly and time-consuming. With 3D printing, prototyping can be done easily and quickly.

However, once the 3D printed prototype is in hand, transitioning it to manufacturing is a different process altogether, and one that is not as straightforward as it appears. One of the main challenges is that not everything that can be printed, can be mass manufactured using conventional methods. Factors like material limits and structural features can affect how manufacturable a design or prototype is. Therefore, it is important to consider all aspects of the prototype, from material choice and its physical properties, to cost, quality control and whether it can ultimately be translated to the final manufacturing stage, said Soon.

Another related challenge is that the 3D printed models can mask weaknesses or design faults that only become evident in the final manufactured product. An example in the case of a moulded part is how 3D printed models allow for the presence of features like undercuts, or varying wall thickness, yet the resulting products cannot be mass produced. Other aspects, like the different material strengths conferred by the grain orientation of the plastic used in 3D printed models, likewise cannot be reproduced in the final manufactured product.

To overcome the challenges of each 3D printing method, Soon stresses that it is important to keep in mind their individual limitations and feasibility. The most important step is to know your purpose with prototyping. Once your purpose is clear, it will not be difficult to choose the correct approach, said Soon. With 3D printing specifically, he recommends always having a single clear objective for each printed part and keep in mind how it relates to actual production later on.

Prototyping insights from an expert

Soon also offers some guidelines to help gauge if a 3D printed prototype is valid for manufacture and mass production:

- Make sure the 3D printing materials used in the prototype and the final production materials are similar and share the same characteristics or consider other methods of prototyping.
- If 3D printing is chosen as the production method, determine that the material and printed parts are consistent. Also make sure that the individual parts are designed to be suitable for replication during mass production.
- 3D printing is a good choice for quickly checking design features. But you must realistically evaluate the feasibility of your design by considering how conditions in the 3D printed prototype may differ from the final manufactured product, such as the strength and toughness of printed parts.

Soon's experience in this transition is exemplified in a case where Protoking was engaged by a company to help actualise a 3D printed prototype of a component in their product. This component was a soft actuator that featured a continuous, hollow wave-like form to enable bending, but this form was impractical for actual manufacturing machines to produce. However, this part was critical as the entire product revolved around the specific structure of that component. Soon and his team managed to solve the problem by overhauling the design of the component so that it would keep its desired form but in a way that could be manufactured.

The additional time and effort spent on changing the design could have been avoided if a manufacturing solutions company like Protoking had been involved immediately after ideation or proof-of-concept to advise the team on the manufacturability of their early designs, said Soon.

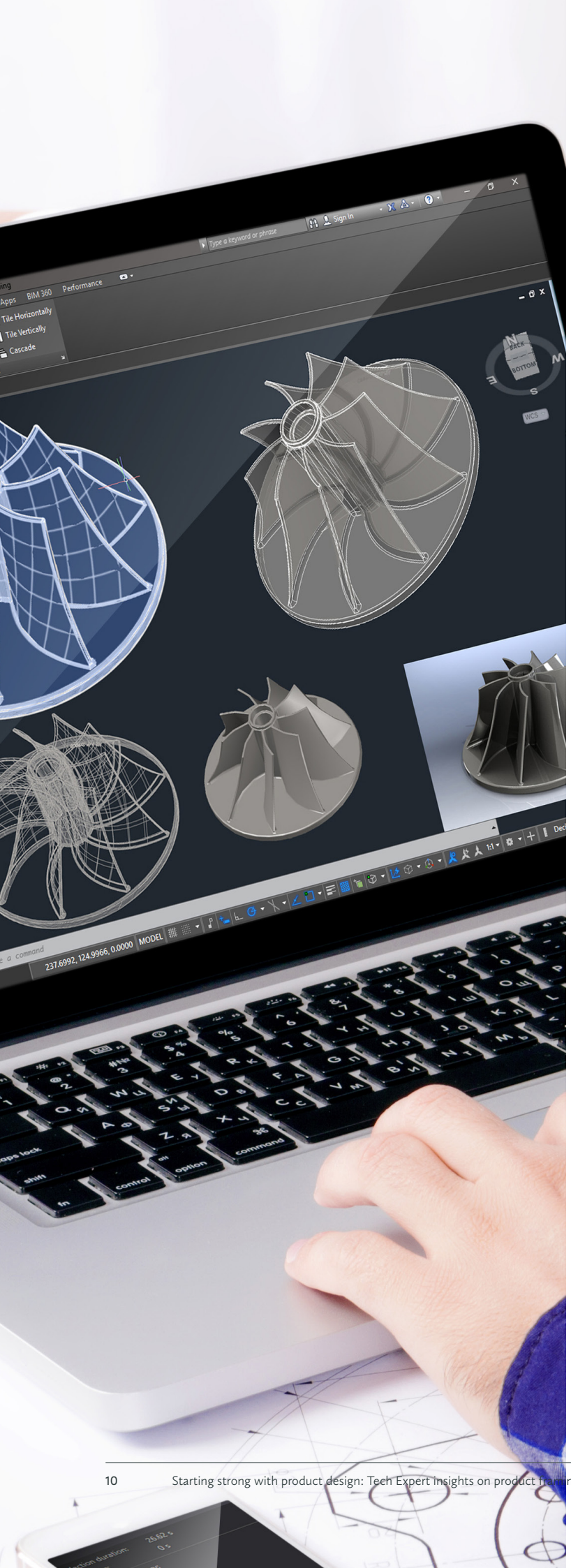
Despite these complications and limits, Soon believes that 3D printing technologies will continue to move forward and will be the future of manufacturing. In the transition to that future, gaps in your knowledge are only to be expected.

To circumvent these gaps, Soon recommends getting help as needed on an ad hoc basis. For example, always check with a production engineer from your contract manufacturer when in doubt or engage an engineer with production knowledge to join the project team.

"It is important to remember that the whole product development process is like a big mechanism running with inter-locking gears. Just like in design thinking, a diverse group for opinions and thoughts will take you a long way," Soon said. "You need not think out of a box if you do not confine yourself in one."

It is always better to involve someone with the right expertise and experience as early as possible. Earlier consulting, as early as the design stage with a Tech Expert with experienced knowledge in materials and manufacturing methods, before moving forward with the prototype can reduce the risk of costly mistakes or corrections down the line.

YOU NEED NOT THINK OUT OF A BOX IF YOU DO NOT CONFINE YOURSELF IN ONE.



CONCLUSION

Many challenges can arise in the product development cycle, especially if the initial stages of product framing and prototyping are not done well. To reduce potential complications and costly changes or failures down the line, early and careful consideration of these stages is key. A sound strategy to ensure this is to utilise external expertise to strengthen or complement in-house product design, innovation, and development capabilities.

IPI Tech Experts can provide such support at multiple stages of the early product development process, such as in framing, product design and prototyping. Their expertise in design and development encompasses a diverse range of sectors such as healthcare, consumer electronics, manufacturing and more.

If you would like to find the right experts to support your innovation journey, please contact: **techexpert@ipi-singapore.org**.

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Jeremy Sun heads Orcadesign Consultants, an award-winning strategic design and research consultancy. He has led design thinking, ethnographic research and innovation programmes for Fortune 500 companies and government agencies, guiding stakeholders to reframe their challenges, create compelling visions and craft innovations that resonate with their target audiences.

Garrick Soon
Director
Protoking

Garrick Soon is the founder of Protoking, a manufacturing solutions company that helps enterprises in the product development process from ideation to manufacturing. He began his career as an apprentice in a tool and die making company, later mastering plastic injection moulding from a veteran moulder. He grew to become a specialist in prototyping and design for manufacturing.

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